

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Volume 67

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Number 24

NORMAN G. SHIDLE, Directing Editor

LESLIE PEAT, Managing Editor

P. M. HELDT, Engineering Editor ATHEL F. DENHAM, Field Editor
JOSEPH GESCHELIN, Eng. Editor HERBERT HOSKING, News Editor
GEOFFREY GRIER, Art Editor

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C. A. MUSSELMAN, President and General Manager

J. S. HILDRETH, Vice-Pres. and Director of Sales

W. I. RALPH, Vice-Pres. G. C. BUZBY, Vice-Pres.

A. H. VAUX, Secretary and Treasurer

JOHN A. CLEMENTS, Asst. Treasurer

JULIAN CHASE, Business Manager GEO. D. ROBERTS, Advertising Manager

Cable Address.....Autoland, Philadelphia

Telephone.....Sherwood 1424

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St., Phone Pennsylvania 6-0080

Chicago—367 West Adams St., Phone Randolph 9448

Detroit—710 Stephenson Bldg., Phone Madison 2690

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Automotive Industries



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Only long experience in the manufacture of Clutch Discs can tell a manufacturer what is necessary for satisfactory performance in automobile, truck or tractor service.

This company has concentrated its efforts for years on the manufacture of custom-built Clutch Discs of precision. The result of that skilled experience shows in the perfection of its finished product.

And because of solving so many perplexing problems in this field, the Curtis Company is particularly qualified to give expert advice as to your particular needs. Correspondence is invited.

CURTIS CLUTCH DISC CO.
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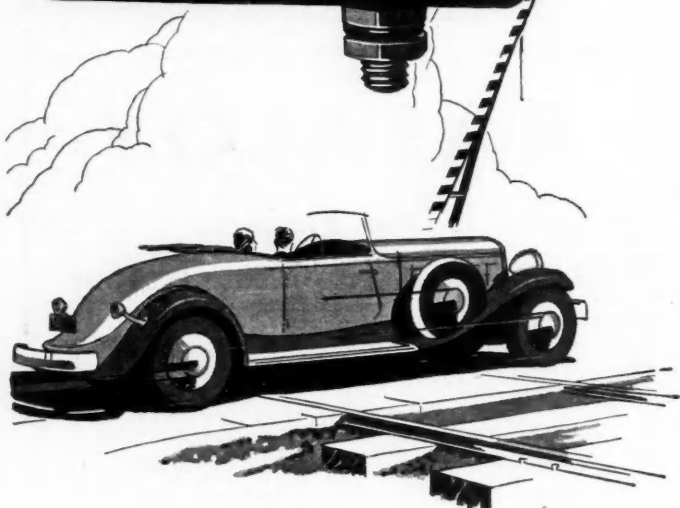
Cerro de Pasco Copper Corp.
44 Wall St. New York City

December 10, 1932

Both mean

BENDIX STARTIX

THE AUTOMATIC STARTING SWITCH



The

**BENDIX
DRIVE**

Standard on more than twenty million cars running today. So reliable, so dependable, its performance is taken for granted.

December 10, 1932

No unit in recent years has added more to the safety and convenience of motoring than Bendix' newest contribution—Startix.

Startix means safety because it automatically protects you from the danger of a stalled engine in traffic, on hills and at railroad crossings.

Startix means convenience, too, because it eliminates the need of a starter button. You simply turn the ignition key "on" and Startix starts the engine instantly; automatically re-starts the engine if it stalls—all without thought or effort on your part. Startix is always in full automatic control of your engine as long as the ignition is turned "on".

Startix is built by the makers of the Bendix Drive; its convenience and safety features have led to its adoption on many of the new 1933 model cars. Startix can be easily installed on any car equipped with the Bendix drive. Any car is a better car if it is Bendix-equipped.

ECLIPSE MACHINE COMPANY, Elmira, New York
ECLIPSE MACHINE COMPANY, LTD., Walkerville, Ont., Canada
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AUTOMOBILE

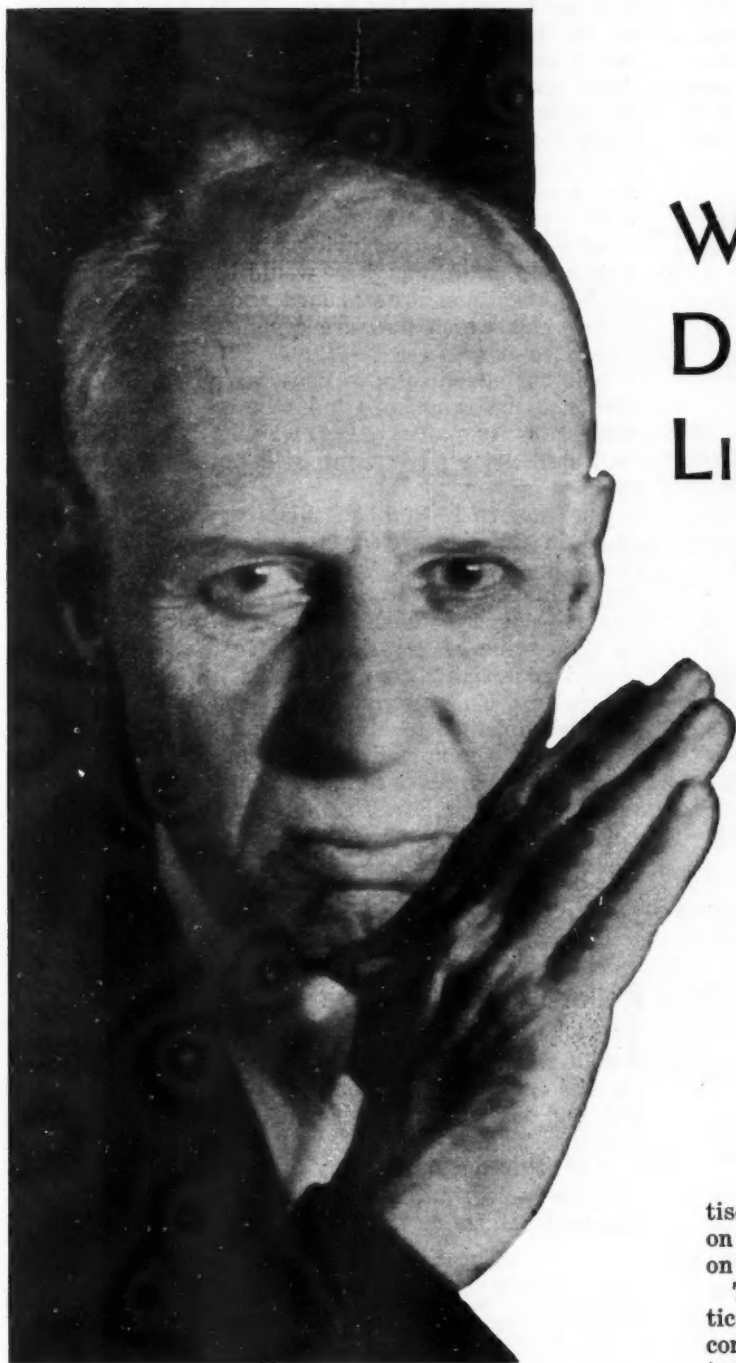
Automotive Industries

AUTOMOTIVE INDUSTRIES

Vol. 67, No. 24

• THIRTY-FOURTH YEAR •

December 10, 1932



Whispered "EXTRAS" Destroy Value of LIST PRICE Scheme

John Public and industry
alike have little respect
for advertised cost, which
means practically nothing

by Norman G. Shidle

MR. Public today is no respecter of list prices so far as automobiles are concerned.

The industry itself is to blame. John Public can't be made to respect our list prices until we begin to respect them ourselves.

Competitive jockeying to make the advertised list price as low as possible has resulted in merchandising absurdities that would be laughable if they weren't so serious a part of the selling structure of our business.

Because of this striving for a low list price to adver-

tise, "standard" equipment has become obtainable only on special order and "special" equipment is standard on nearly every passenger car delivered.

The truck industry is afflicted with the same practices under slightly different conditions. One truck company lately took the bull by the horns and started to bill as standard certain "special" items which were being so frequently ordered as to outsell the previously "standard" equipped models by a considerable margin.

In the case of this particular truck company the facts came to light only as a result of a careful analysis of orders. In the case of the average passenger car company no such analysis is needed. The universal demand for certain equipment now sold only at extra cost is perfectly well recognized when it is made special. Recognition is so clear, that, in the case of certain items classed as "special" no car is shipped from the factory without those items.

It is difficult to find logic in a merchandising scheme which commonly requires special orders to get "standard" equipment.

At present there are about three grades of "equipment."

First there is that accessory equipment which actually is included in the list price of the automobile as advertised.

Next there are a few items of additional equipment for which the dealer—and in turn the public—is charged extra, but which are shipped with every automobile turned out by the factory and which the dealer and the public can refrain from buying only at the expense of considerable argument and the sending through of a "special" order.

Finally there is what might be termed "extra-extra equipment" which the factory is glad to furnish on order, but which *really is special* in the sense that it is sold in addition to the list price, in addition to the factory-recommended delivered price and is not forced on either the dealer or the public.

Re-Delivered Prices

If the industry went to advertising of only delivered prices—and there is more serious discussion of such a move today than ever before—it would seem as though the public would get a better break, at least so far as being able to understand exactly what it was getting. The price which a prospect read in the newspaper would have to include all of the equipment items which he would be forced to buy. In other words if the advertised price were \$1000, Mr. Prospect would be able to walk in and say "What equipment is included in that price?" and get a definite answer from the dealer. AND the dealer would be able to deliver him the automobile with that specified equipment for \$1000.

Today, Mr. Prospect walks in and says: "What equipment is included in the list price of \$900?"

The dealer tells him.

Then he may ask: "How much for freight and handling."

Suppose the dealer replies honestly: "\$80."

Then, Mr. Prospect says: "OK. I'll take the car with the equipment you mentioned. Here is my check for \$980."

Seems simple enough, doesn't it? *But it can't be done.*

Instead the dealer must say something like this: "Well, of course this car has safety glass all around as well as in the windshield. That costs \$15 extra. Also it has bumpers on it, which will cost \$20 more. Then it has a special radiator cap for which you must pay another \$1 extra, not to mention these other useful doodads which cost another \$20. So you will have to draw your check for \$1036 instead of \$980."

"But I don't want those other items," Mr. Prospect protests. "I want just what comes with the list price of the car plus freight, handling and tax."

What's the dealer to do?

The answer is easy. Either he sells the extra equipment to Mr. Prospect or he takes it off and keeps it himself, because he has already bought it from the factory.

Actually, of course, few conversations of this exact nature take place. Long practice has made dealers adept at confusing the issue, glossing over the details and making it difficult for any but the most keen minded prospect to pin him down on just exactly what is included in the list price and what isn't and what

goes to make up the difference between the list and the delivered price.

Plenty of prospects have been sold without being convinced and plenty have been unsold by the confusion.

Adoption by the industry of advertised delivered prices would, as we have mentioned, probably improve this particular situation somewhat from the standpoint of the public. Most manufacturers, it is assumed, would include in the advertised delivered price all of those accessories which regularly and automatically are shipped with every car. Several makers have already indicated that this would be their practice. Almost certainly it would be universal, because the dealer would find it nearly impossible to sell at a delivered price higher than that advertised.

Advertised delivered prices, in other words, probably would mean that there would be actually just two kinds of equipment—standard and extra; instead of three kinds which now are common—standard, extra and extra-extra.

Whether advertising of delivered prices be resorted to or not, the automobile industry needs to reestablish respect for its quoted prices, whether list or delivered. Delivered price advertising will not solve the whole problem by any means.

One way to reestablish this respect will be to include in the list price of every automobile at least those items without which only 5 per cent of all automobiles today are sold. Bumpers and a spare tire are almost as much a part of an automobile today as the engine. They should be in the list price.

And advertising charges should be included in the list price. The advertising charge item cannot be frankly explained to Mr. Prospect by the dealer as a fair part of the spread between the list and delivered price. It helps make necessary the creation of a certain confusion in Mr. Prospect's mind by the dealer.

Respect for list prices will be recreated when the spread between the list and delivered price is easily, logically and simply explainable to the *average* prospect by the average dealer.

Roller-Bearing Lubrication

TO cope with the varied problems of industrial ball and roller-bearing lubrication, E. F. Houghton & Co. has completed a comprehensive study of the subject, and published in condensed form in *The Houghton Line* for October, 1932.

Operating temperature is found to be the most important factor, and since it may vary from job to job, will determine the type of lubricant to be used.

OIL RECOMMENDATIONS

Saybolt Viscosity of Recommended Oil at 100° F.

Operating Temp. °F.	Normal Loads and Speeds	Normal Loads and High Speeds	Heavy Loads Normal Speeds
0—32	100*	82*	100*
33—60	100*	82*	120*
61—95	105	82	160
96—125	160	100	400
126—150	530	400	700
151—180	945	530	1,500
181 and over	Steam Cyl. Oil	1,500	Steam Cyl. Oil

* Note—These oils should have a cold test of not less than —35° F.

GREASE RECOMMENDATIONS

Operating Temp. °F.	Normal Loads and Speeds		Normal Loads High Speeds		Heavy Loads Normal Speeds	
	Consistency	Melting Pt. °F.	Consistency	Melting Pt. °F.	Consistency	Melting Pt. °F.
0—30	Soft	150	Soft	150	Soft	150
31—75	Soft	150	Soft	150	Soft	150
76—100	Med.	160	Med.	160	Med.	160
101—150	Med.	250	Med.	250	Hard	300
151—170	Hard	300	Hard	300	Ex. Hard	350
171 and over	Steam Cyl. Oil		Steam Cyl. Oil		Hvy. St. Cyl. Oil	

JUST AMONG OURSELVES

Time Is Money

EIGHT or nine months ago we wrote an article, the theme of which was this: "If factories are going to ask hundreds of dealers to spend time and money attending regional sales meetings, the executives participating in the meetings owe it to those dealers to plan the meeting in advance, rehearse a bit if necessary, and, in general, make certain that the basis for a good meeting has been carefully laid in advance."

Never was such planning and stage management quite so necessary as it is this year. Retailers of every type of automotive product have less time and money to waste than ever before. Many important executives are poor stage performers at a dealer meeting. Such executives, however high their rank, owe it to their organizations to permit themselves to be rehearsed as part of a well-planned well-organized, well-stage-managed dealer meeting.

Planning Builds Sales

WE ARE inspired to renew this subject, not only because sales-meeting time has arrived again, but because we have been attending a few. Those which we have attended thus far have been, for the most part, the best run meetings we have ever attended. And some of those which come later are going to impress retailers unfavorably

in comparison if they, too, are not stepped up above the tempo of former years.

We haven't been the rounds by any means, as yet, so what we are about to say is not in the nature of a comparison in any sense. But we just can't help remarking that this Chrysler-Dodge-Plymouth-DeSoto crowd is doing a bang-up job on their dealer sectional sessions this year. Most of the material presented has been excellent, but of even greater importance is the fact that its method of presentation has apparently been worked out carefully *and in detail*. The meetings give evidence to the dealers who come of the fact the factory has considered the occasion of sufficient importance to prepare for it actively and methodically. And the result is that those attending go away with a feeling of enthusiasm and of time well spent.

Engineers Add the "Why"

WE'RE often impressed, incidentally, as we go around to sales meetings held by car, truck or parts factories with the potent job that the chief engineer can and usually does do when he's given a chance. While technical men notoriously are not good platform performers, the very fact that they aren't often increases the impressiveness of what they say at these gatherings.

Without prompting—just by nature as it were—they usually

answer specifically that big question "WHY?" which so often is left in the dealers' minds after the sales group has spent several hours telling them WHAT. We've heard George Allen of Dodge, Barney Roos of Studebaker and plenty of other engineering executives do a fine job along these lines.

Meetings That Accomplish—

AND while still on this subject of sales meetings, we can't help but mention that tremendously successful gathering of distributors which Pierce-Arrow had in Buffalo a few weeks ago under the leadership of Roy Faulkner, inspiring new president of Pierce-Arrow Sales Corp. We didn't get to Buffalo until a week after the meeting had been held, but the place was still reverberating with enthusiastic echos in the nature of letters and telegrams from those who had attended and of eager optimism on the part of everybody around the factory. We felt as though we must have missed something.

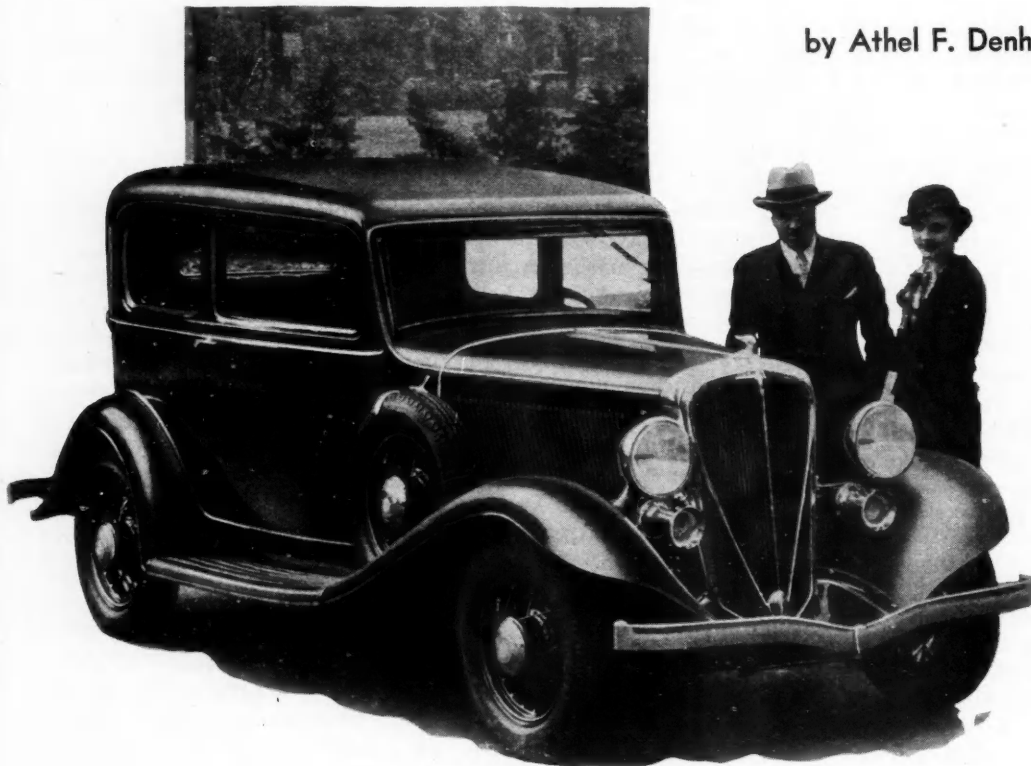
Now having gone this far we might as well take our hair right down in public and admit to a secret weakness. We like to go to real sales meetings: not luncheons and dinners and after-dinner speeches and such like; but to practical working sales sessions where work is being done and where one gathers that enthusiasm of creative effort which comes only through participating—even as a spectator—in the inspiring things which are being done to push this great old industry back to prosperity.

Yes, even after nearly thirteen years of it, we still get a real thrill out of a first class sales gathering.

N. G. S.

ROCKNE Enters 1933 With Single

by Athel F. Denham



The Rockne two-door sedan, which has 2½ in. more leg-room.

THE 1933 Rockne Six, which will make its first appearance at the New York Automobile Show on Jan. 7, represents a refinement of the 1932 Model 65. In line with recommendations of the National Automobile Chamber of Commerce, Rockne Motors Corp. is reducing its products to a single line of cars, reducing the number of models to be stocked by dealers.

Prices, according to George Graham, vice-president in charge of sales, will remain unchanged from the 1932 series. In consideration of the fact that Rockne did not get into production until well along in the spring, on its most popular model, the 65, its record for the past year has been highly satisfactory. According to Mr. Graham the company has lost no money, and has obtained the highest percentage of its price class for a brand new car since Dodge's great success. During this time it has reached a place among the first ten of the industry in monthly car sales.

For 1933 the Rockne Six will be sold with the emphasis on size and quality rather than price. Along this line, exteriors have been materially refined, interiors even more so, bodies have been lengthened

2½ in. for more leg room in the rear compartment, and over-all height at the same time has been reduced one inch, partially due to the new popular smaller wheels, and partly to detail chassis design. Headroom in the Rocknes has not been sacrificed in reducing height.

Safety glass is standard equipment in windshields this year. Cushion and back springs have been changed to the luxury type, and buttons added so that cushions will retain their shape. Finger-tip control for seat-adjustment represents a distinct improvement over the past series. There are now two interior sun-visors, insulation has been improved on the dash to keep out engine noises and heat. De luxe models are equipped with silk robe cords, ash receivers, silk assist cords, and chrome-plated windshield frames.

Instrument panels are now indirectly illuminated. There are new dial faces and markings, etc. Front and rear fenders have been redesigned for better streamlining. They carry down farther in front and back to conceal the running gear. Running boards are rolled more on the side and curve up into the front fenders. Hoods have a new appearance with

Front compartment showing
new trim and instrument
panel



Line of Sixes

sloping louvres paralleling the front door line. Side splashers are removable with the running board, without disturbing the body. On the de luxe models there are two outside chrome-plated horns. Bumpers are new, with full bar type at the rear. Vee-shaped radiators appear to slope more than formerly. De luxe models have six wire wheels with fender well equipment, trunk racks, and sheet metal painted to match the bodies.

Mechanically there are few changes, a highly interesting fact in a first year car, and an excellent commentary on the ability of Roy E. Cole, chief engineer and Ralph Vail, vice-president in charge of production for Rockne, to design and build, from scratch, an automobile remarkably free from service troubles.

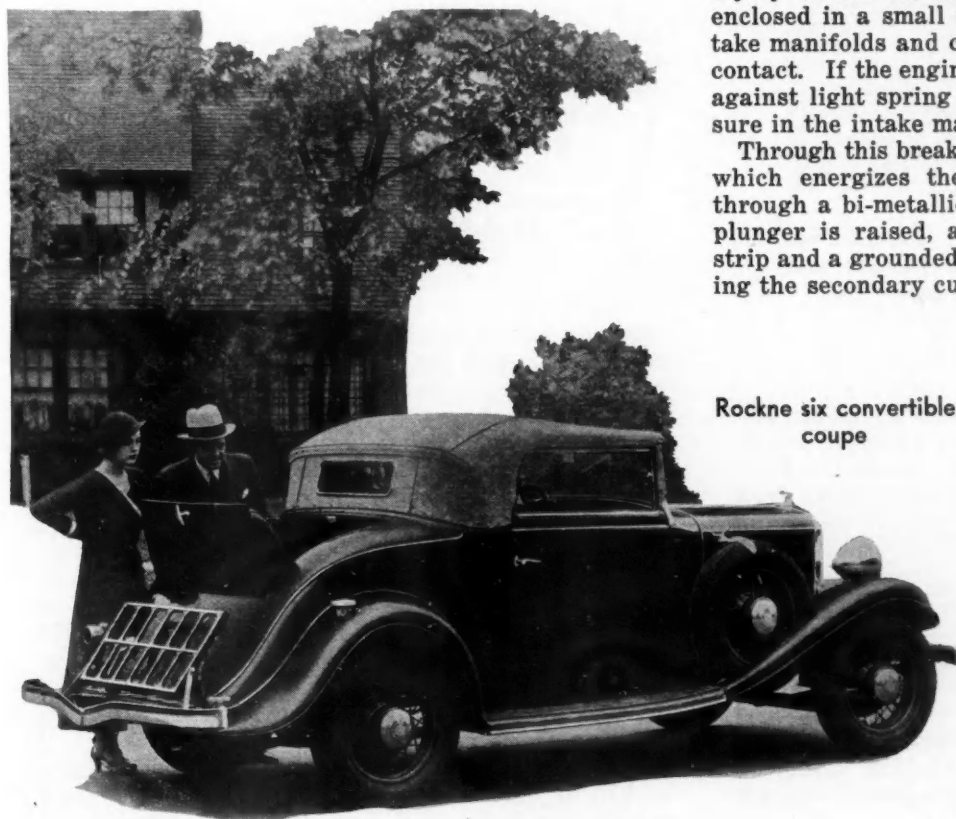
In the engine, aside from improvements in manufacturing methods, there are only three changes worth recording. Reinforcing ribs have been added to the combustion chamber roof in the cylinder head, bearing caps have been stiffened, and compression ratio increased to 5.5 to 1 to improve performance by

increasing maximum horsepower from 65 to 70 at 3200 r.p.m.

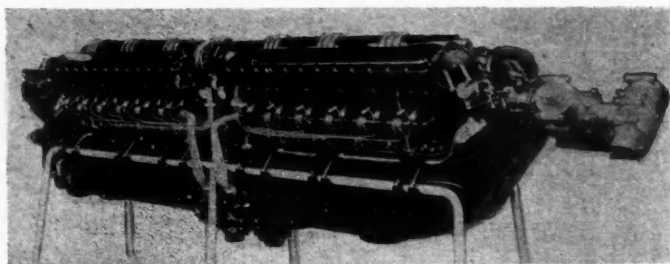
An interesting little device has been added to the Startix automatic starter which is standard equipment on the Rockne. This device is a circuit breaker for the startix in case of engine backfire—preventing injury to the starter under such conditions. It is enclosed in a small die casting mounted on the intake manifolds and contains a thermostatic bi-metal contact. If the engine back-fires, a plunger is raised against light spring pressure by the resultant pressure in the intake manifold.

Through this breaker is wired the secondary current which energizes the Startix, the current passing through a bi-metallic thermostatic strip. When the plunger is raised, a contact is made between this strip and a grounded arm, momentarily short-circuiting the secondary current. The additional resultant current passing through the strip heats it, and the strip curls upwards, breaking the normal connection.

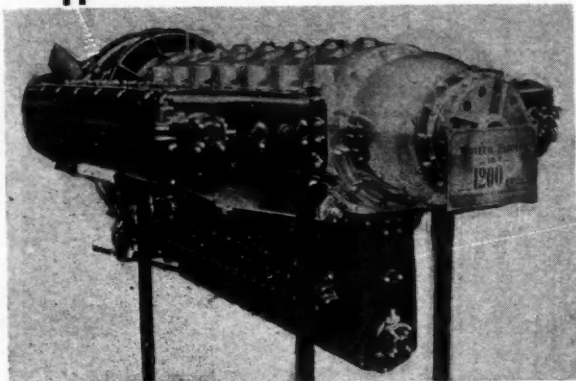
As long as the engine rotates backward, this short circuit is maintained by manifold pressure on the plunger—preventing the strip from cooling. When the backward rotation ceases, the plunger drops, breaks the short circuit, the thermostatic strip rapidly cools, and closes the circuit to the Startix once more.



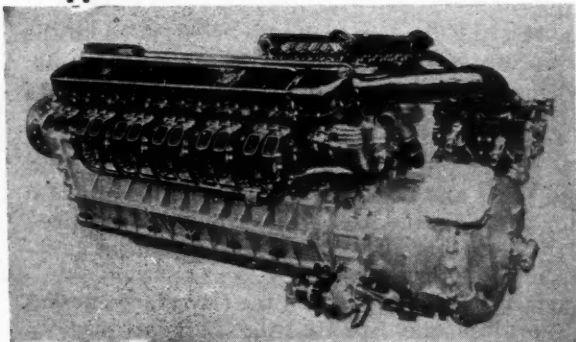
Rockne six convertible
coupe



Fiat 24-cylinder supercharged, geared-down Schneider Cup type engine of 2800 hp.



Farman inverted T type engine of 1200 hp.



Renault 12-cylinder 1500-2000-hp. engine with supercharger and reducing gear

APPLYING racing car experience to airplane engine construction, Delage presented a 450 hp. inverted 12-cylinder power unit at the Paris Aviation Show. The Delage differs essentially from other airplane engines in its high speed, the use of Roots-type compressors, and its external shape which makes it a streamlined unit to be bolted to the front of a fuselage. No cowling is required.

The two cylinder heads are of aluminum alloy, with bronze seats and valve guides. The cylinder barrels, which are of nitralloy steel having separate jackets, are bolted to the head by means of a flange, and head and barrel are passed into the crankcase and secured to this latter by means of the head. The cylinders, therefore merely act as guides for the pistons and are not in tension.

December 10, 1932

Paris Aviation

by W. F. Bradley

The two banks of cylinders are slightly offset, to allow opposite connecting rods to be mounted side by side. Roller bearings are used for both the crankshaft and the connecting rods. The shaft is assembled with its rods and pistons and then mounted in the crankcase, being bolted to it by means of flanges on the main bearing caps, so as to add to the rigidity of the housing.

A special type of valve gear is used after having been employed first on racing and later on stock cars. The valves are operated by push rods and rockets, but instead of the springs being on the valve stems, they are mounted under a rocker having arms of unequal length, one end of the rocker being forked and engaging under a collar on the valve stem. There are four valves per cylinder.

The two Roots-type blowers are at the rear of the engine and draw from a single Zenith carburetor. They weigh 37 lb., turn at 6000 r.p.m., and deliver 18 cu. ft. of air per second at ground level. One of the features of the superchargers is that part of the air is by-passed from the outlet to the inlet through a barometric valve which does not completely close until an altitude of 16,000 ft. is attained. Thus the pressure in the intake manifold remains constant until this height is reached. Two magnetos are used for ignition. They are mounted on opposite sides of the crankcase, within a housing forming part of the case, with a detachable metal cover. The electric generator and the oil filter occupy similar housings closed by sheet metal plates.

The engine, which has a piston displacement of 732 cu. in., turns at 3600 r.p.m., with a propeller speed of 1700 to 1900 r.p.m. There are two sets of reducing gears, the first being by double helical gears and the second built under Farman license. There is high-pressure lubrication to the accessories and the reducing gear, and low-pressure for the main and connecting rod roller bearings. The oil tank is on top of the engine, above the crankcase. There is a separate oil pump for lubrication when flying upside down. A second and smaller engine, with a piston displacement of 488 cu. in., is being built. It will be used in the Deutsch Cup races next year.

High-powered engines, designed for (but not used in) the Schneider Cup races, are exhibited on several stands. The biggest is a 24-cylinder Fiat said to develop 2800 hp. at 3200 r.p.m. and weighing 2024 lb. This consists of two 12-cylinder V-type, water-cooled, supercharged engines mounted in tandem, driving two propellers in opposite directions through reducing gear.

Farman has an inverted T-type 18-cylinder engine of 4.73 in. bore and stroke each, having a volumetric compression ratio of 6, and developing 1200 hp. at

Automotive Industries

Show Reveals Developments In Reduction Gears and Superchargers

3400 r.p.m., with a peak of 1480 hp. at 3700 r.p.m. Its features are aluminum-alloy cylinder blocks with liners, four valves per cylinder, with an overhead camshaft driven by a vertical shaft and bevel gearing, and a centrifugal-type compressor delivering air through a radiator to six carburetors. The patented Farman gear reduces the propeller speed in the ratio of 2.6 to 1. The weight of the engine in running order, but without gas, oil, or water, is 1060 lb.

Renault's most powerful unit is a 12-cylinder water-cooled V-engine, of 1500 to 2000 hp. It has a centrifugal blower at the rear delivering mixture through a separate carburetor for each bank of cylinders, four valves per cylinder actuated by an overhead camshaft, and a reducing gear in front.

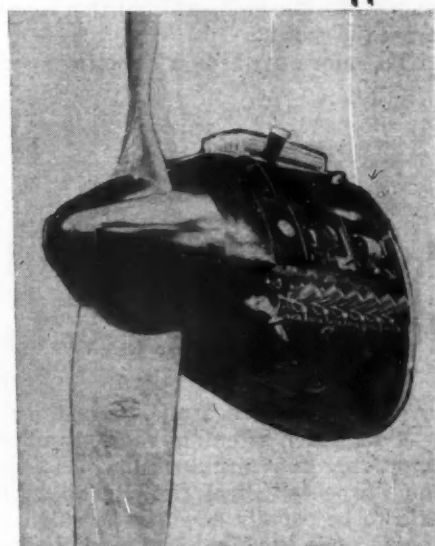
The 1000 hp. unit which passed its official tests this year is the 18-cylinder open-W model shown by Hispano-Suiza. Its general lines of construction are similar to those of other Hispano-Suiza models, with bore and stroke of 5.90 by 6.70 in., compression ratio 6.2, and weight, dry, of 1350 lb. There are nine Hispano-Solex carburetors, or three for each bank of cylinders. A planetary type reducing gear is fitted, giving a reduction of either 1.61 or 2 to 1. Nominal engine speed is 2000 r.p.m.

The show reveals developments in the use of reducing gears and superchargers. Two new models along these lines are shown by Hispano-Suiza, both of them being 12-cylinder V models, of 650 and 500 hp. respectively. These two have a centrifugal blower driven off the rear end of the crankshaft, delivering air to three carburetors on the outside of each bank of cylinders. The overhead camshafts and all the accessories are driven from the rear, while at the front there is a spur-type reducing gear giving a reduction of 3 to 2. The two models are similar, except that one has a cylinder bore of 5.12 and the other of 5.90 in., the stroke in each case being 6.70 in. The compression ratio is 5.8, and the weight, dry, 814 and 946 lb., respectively.

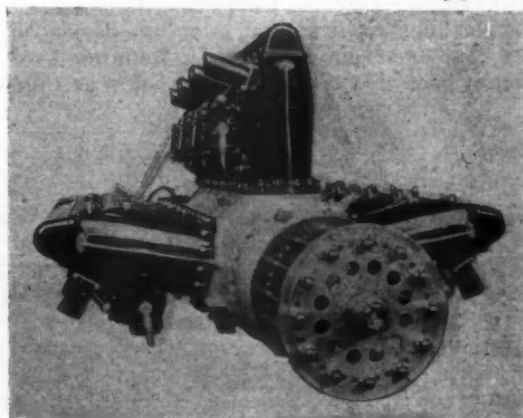
Farman has two inverted 12-cylinder engines of entirely different design. The larger of the two, of 4.33 by 4.33 in. bore and stroke, has two blocks of Alpax (aluminum alloy) cylinders with steel liners, mounted separately on the crankcase, but united at the front by the timing gear housing, and below by another housing enclosing the valve gear and forming an oil collector. The rigidity of a block casting is obtained, with the advantage of separate banks for machining and assembly.

There is a single camshaft, mounted in the angle of the V, for the 24 valves, the shaft being driven by a train of gears. The valves are side by side and removable through holes with threaded plugs or valve caps on the outside of each cylinder block. A three-bearing crankshaft is fitted, with forked type connecting rods. A centrifugal, clutch-controlled two-stage compressor is used, of the same type as that for the special plane

expected to attempt to break the world's altitude record before the end of the year. The air is passed through a cooler before being delivered to the six Zenith carburetors. The propeller is driven through a Farman reducing gear giving a ratio of 2.5 to 1. At ground level the output is 510 hp. at 3400 r.p.m., and it increases to 800 hp. (at ground level) with the



Front view of Delage inverted 12-cylinder engine



Hispano-Suiza 18-cylinder 1000-hp. engine of the open-W type

second stage compressor in engagement. The weight of the engine, dry, is 638 lb.

The second Farman is a 60-deg. 12-cylinder model of 3.56 by 3.94 in. bore and stroke, having a compression ratio of 7.5 to 1, and developing 420 hp. at ground level at 4000 r.p.m., for a weight of 506 lb. A combination of air and water cooling is used, the cylinders being of steel, with fins on the barrels for direct air cooling, and the upper portion of each bank of six surrounded by an aluminum-alloy water jacket. The valves are in the head, operated by an overhead camshaft driven by spur gearing. The crankshaft is on seven bearings, with forked type rods. A single-stage centrifugal blower, with a slipping clutch, delivers air through a radiator to four Zenith carburetors. A Farman gear gives a reduction of 2.25 to 1.

Potez, who in the past has figured as an airplane manufacturer only, has taken up engine production, with a horizontal opposed 12-cylinder model, using the Rateau exhaust-driven supercharger. The engine, which has not yet undergone its tests, will, it is stated, develop 400 hp. The blower is mounted on a vertical shaft and takes part of the exhaust from the top of the cylinders. The air scoop is on the bottom. The overhead camshafts and all the accessories are driven from the front.

The move towards air-cooling, which was a strong

feature two years ago, does not appear to have made much progress among Continental manufacturers, although all are maintaining the air-cooled types they produced at that period. Direct air cooling is much more strongly represented among the English makers, notably Armstrong-Siddeley and Bristol, as well as by Gnome & Rhone, building under Bristol license. An automatic booster control is shown by Bristol on its supercharged air-cooled models, this device limiting the throttle opening at low levels, but having an over-riding hand control enabling the pilot to momentarily get full power for taking off or emergencies.

There is little that is new in heavy-oil developments. Hispano-Suiza exhibit both a 7 and a 14-cylinder air-cooled Diesel built under Clerget patents. Compagnie Lilloise des Moteurs (one of the Peugeot subsidiaries) has a two-stroke, two-crankshaft, six-cylinder opposed piston engine, the crankshafts being united by spur gearing. The engine is equipped with a Rateau two-stage centrifugal blower and has direct injection with opposed spraying devices. With a bore and stroke of 4.13 by 6.30 in. it develops 480 hp. at 1900 r.p.m. at ground level and 530 hp. at 2100 r.p.m., with a weight of 1104 lb., supercharger and reducing gear included. The propeller is driven from the second pinion down from the upper crankshaft, being geared down from 1900 to 1200 r.p.m.

Improving the Machinability of Rustless Steel with Selenium

A NEW rustless steel of good machining qualities in which selenium replaces sulphur as an agent, improving the machinability, has been developed by the Carpenter Steel Co., Reading, Pa. Selenium is said to be equally effective as sulphur as regards improving the machinability, and it is said to overcome some of the objections to a high sulphur content. The following information on the new steel is taken from *Iron Age*:

Selenium is a by-product of copper smelting and the manufacture of sulfuric acid. It is introduced into the steel by the Carpenter Steel Co. in the form of an alloy of iron and selenium developed specially by the American Smelting & Refining Co., a typical analysis of this ferro-selenium being as follows:

Selenium	52.11	Silicon	0.72
Iron	41.42	Phosphorus	0.20
Carbon	0.90	Sulfur	0.22

The ferroalloy is heavier than pure selenium and is more readily assimilated by the steel bath.

The first commercial use of selenium steel has been in a free-machining 18-8 rustless steel known as Carpenter stainless steel No. 8. This is an austenitic steel containing approximately 18 per cent chromium, 9 per cent nickel and 0.25 per cent selenium. When this brand of free-machining 18-8 was first announced by the Carpenter company a few months ago it contained about 0.30 per cent sulfur as a free-cutting agent. The sulfur has now been replaced by selenium.

The finished product is so freely machinable that it can be cut in automatic screw machines at 60 to

70 per cent of the speed of Bessemer screw stock. It can be drilled, tapped, threaded and otherwise machined with ordinary machine shop tools and practice.

Tensile and impact tests made transverse to the direction of rolling on free-machining 18-8 steel furnish an interesting comparison between the effect of sulfur and selenium as free-machining agents. Holding all other conditions equal, the selenium steels have about one-third greater elongation and reduction of area and twice the Izod impact resistance. The ultimate strength is the same.

The greater transverse toughness of 18-8 containing selenium reflects in several ways upon the fabrication and use of the product. The selenium steel is easier to roll and forge than the sulfur types—being less subject to splitting, cracking or opening up at the ends. The selenium steel can be upset with greater safety and less trouble from splitting. High sulfur 18-8 is utterly useless in the form of sheets or strips because it will stand practically no longitudinal bending and no deep drawing. The selenium steel will do both, although not so well as 18-8 steel without sulfur or selenium.

From a corrosion-resisting standpoint, selenium also has some advantages. It does not impair in any way the resistance to the salt spray test, and it does increase the resistance of the metal to certain chemical solvents such as boiling solutions of acetic acid or aluminum sulphate.

A patent covering the use of selenium in rustless steels was issued last February to Frank R. Palmer, assistant to the president of the Carpenter Steel Co.

AutoTram Seats 42

Weighs 26,000 lb. Net

THE "AutoTram," an aluminum rail car powered with a 16-cylinder gasoline engine, has been built by the Clark Equipment Co., Buchanan, Mich., embodying the latest streamline design. It is completely air-conditioned.

The unit is approximately 60 ft. in length, seats 42 passengers and is built for standard gage railroad track. The total weight, empty, is 26,000 lb., and loaded to capacity will weigh about 32,000 lb., about one-fourth the weight of the modern steel railroad coach.

The body is supported on two trucks as in standard

rail practice, although the designs of the trucks are radically different. Tractive effort is applied to the front wheels only, through a series of specially designed clutches, transmissions and axles to the wheels.

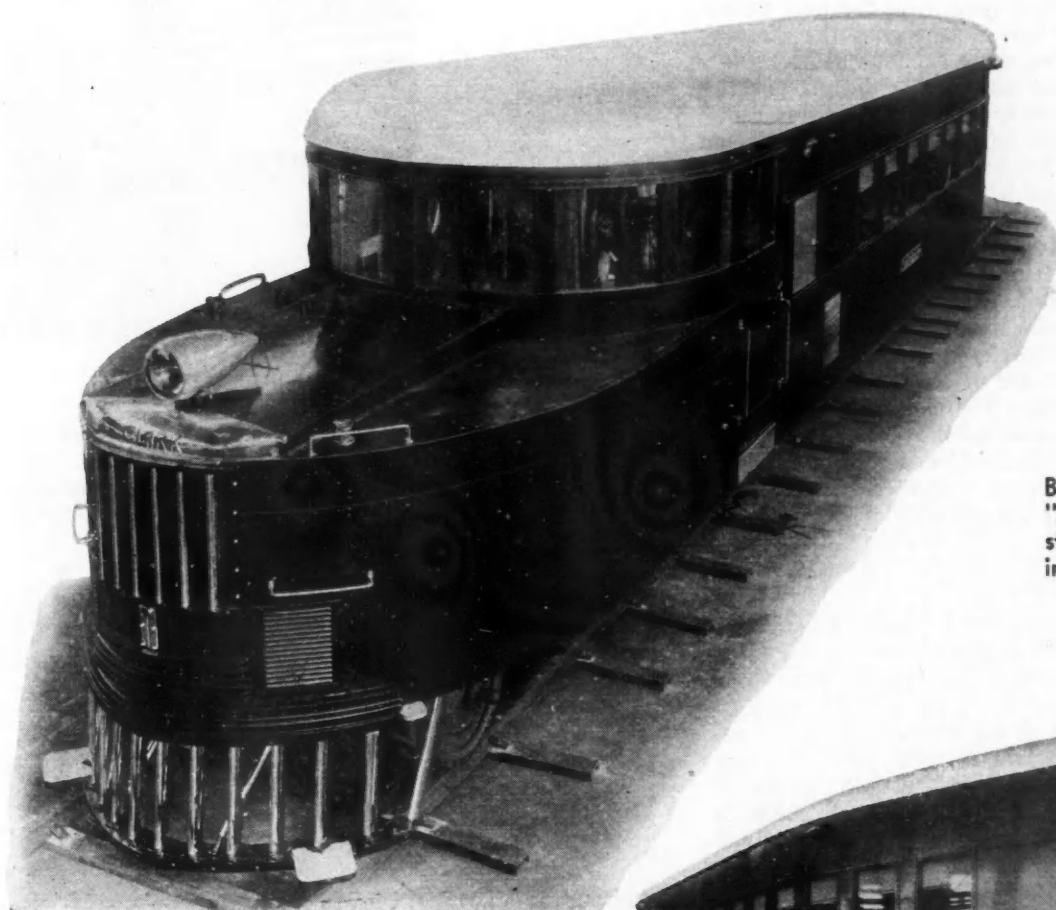
Back of the power plant, located in the deck-like front section of the AutoTram, is a liberal-sized engineer's cab. Then are located an entrance way and toilet rooms.

This design gives approximately 15 feet of isolated space between the engine and nearest passengers, an arrangement which insulates the body of the car from noises and vibrations of the powerplant.

The interior is of the approximate dimensions of a standard railroad car. The floor is three ft. above the rails, or about 15 in. lower than standard cars.

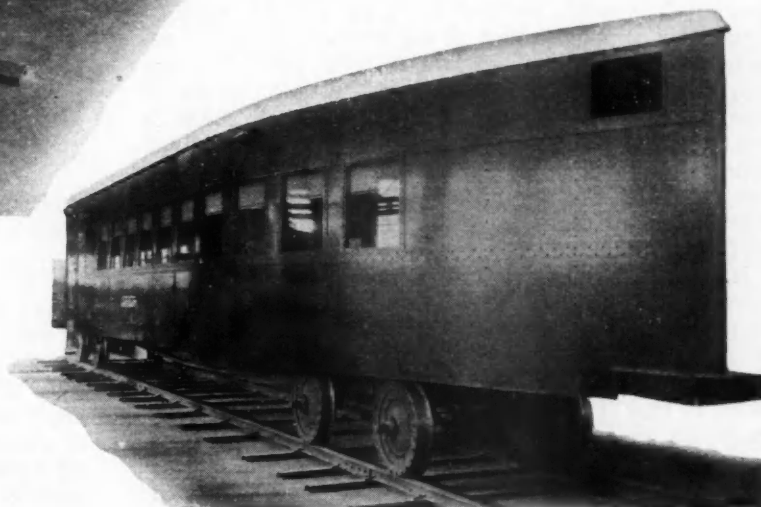
The overall height is about 10 ft. 8 in., or 38 in. less than standard railroad coach design.

The first "AutoTram" will go into service on the Michigan Central and New York Central lines.



Above: Three-quarter front view of the Clark "AutoTram" rail car, which seats 42 passengers. The powerplant is installed in the front compartment, under the deck

Below: A rear view of the "AutoTram" showing the streamlined body, ending in a wedge-like shape at the rear



ANY one observing the operator of a heavy bus manipulating the steering gear when making a right-angled turn at the intersection of two narrow streets cannot fail to be impressed by the amount of physical effort required. Heavy trucks require even more effort in steering, because their loaded weights are still greater. The question naturally arises whether something could not be done to obviate the need for this great exertion on the part of the driver. Evidently the problem can be attacked in two ways—(1) by so changing the design that less torque is required to move the steering wheels angularly around the knuckle pins, and (2) by applying engine power to the steering gear.

A great deal has been done during the past decade to reduce the effort required to swing the steering wheels around their pivot axes, various developments in traffic conditions and automobile design practice having made this absolutely necessary. First of all came the great increase in the number of woman drivers, which followed the introduction of the electric starter and the demountable rim. Women are not as strong as men, and to make it possible for them to drive cars over considerable distances without too much exertion, the operation of all of the controls had to be made easier. Then, with the increase in the congestion in our streets, came the frequent need for parking a car in a very restricted space. This usually requires considerable motion of the front wheels into the extreme positions while the car is at rest, when deflection of the wheels takes all the more effort. And finally came the balloon tire, which, on account of its greater road-contact surface, added further to the torque required to deflect the wheels.

Manual Steering Complications

To reduce the steering effort required, steering knuckles now are generally fitted with anti-friction thrust bearings; the steering-gear ratios have been largely increased, so that in some of the heaviest trucks six complete turns of the steering wheel are required to move the front wheels from hard over one way to hard over the other way. Finally, types of steering gear have been adopted in which there is relatively little friction between the driving and driven members, in which the area of contact between the two members is either quite small, or rolling motion is substituted for the usual sliding motion between these surfaces.

Efforts to reduce friction in steering gears and to increase their mechanical advantage have been carried about to the practical limit. While the elimination of friction is an advantage from the standpoint of ease of operation, it is a disadvantage from another standpoint, in that it promotes shimmy. Also, while an increase in the reduction ratio of the steering gear lessens the pull which must be exerted on the rim of the wheel in order to move it, the wheel must be moved



Power Steering Heavy and High

by P. M.

further to effect a certain deflection of the front wheels, and steering becomes rather slow, which involves an element of danger. The application of power to the steering gear would obviate the necessity of going to extremes with respect to either elimination of friction in the steering system or of the reduction ratio in the gear.

In the design of steering boosters it is desirable to apply some of the same principles that have been found of advantage in brake boosters. Dependability under all conditions is the most important desideratum. It must be possible for the operator to control the steer-



is Demanded by Speed Vehicles

Heldt

ing gear even if the source of power fails. While it is true that the probability of such failure is very remote, dependence on power actuation alone would introduce a new hazard which automobile engineers would not tolerate. Therefore, matters must be so arranged that if either the source of power or the means through which it is applied to the steering mechanism fails, the vehicle can be steered by physical effort alone, the same as if no power steering device was fitted.

Using the engine as a source, power can be transmitted to the steering mechanism either mechanically, hydraulically or pneumatically. Electrical transmis-

sion, of course, is also possible, but so far does not seem to have received any serious consideration for this purpose, and it is not apparent that it possesses any advantages over the other methods mentioned. Pneumatic boosters are of two kinds, viz., vacuum and compressed air, the vacuum being derived from the inlet manifold.

A steering booster consists essentially of two elements, an element for transmitting or generating mechanical power and a control element. The control element must be operated by the steering wheel. With no torque (or pull) on the steering wheel the power must be shut off. If the steering wheel is being pulled in one direction, the power must be applied in such a way as to urge the road wheels around in the corresponding direction, and if the pull on the steering wheel is reversed, the direction of application of the power also must be reversed. In the case of a mechanical steering booster, the application of power is controlled by means of friction clutches, while in the case of either hydraulic or pneumatic steering boosters it is controlled by means of valves.

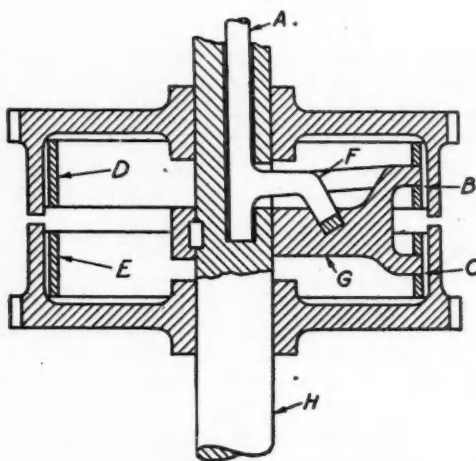
Steering Boosters

In addition to being classified according to the method of transmission from the source of power to the steering mechanism, steering boosters may also be classified according to whether power is transmitted through the reducing gear or is applied to the steering mechanism beyond that gear.

The problems involved in the design of a booster for steering gears are quite similar to those presented by brake boosters and it is therefore not surprising that several of the firms which have been active in the power-braking field also have applied themselves to the solution of the power-steering problem.

The greatest need for power steering exists undoubtedly in connection with heavy trucks and buses. Owing to the fact that these vehicles also are now powered and geared to operate at high speeds, it is no longer practicable to provide them with steering gears of very large gear ratio, so called low gears. The torque which is required to swing the steering wheels of a vehicle around the steering pivots increases considerably faster—for steering mechanisms of general similar design—than the weight on the steering wheels, for the reason that area of ground contact increases with the weight on the wheels. The torque required to swing the wheels around is particularly great when the vehicle is at rest. Now that the brakes of heavy vehicles are in most cases servo-operated, operation of the steering gear is the greatest strain on the driver. Physical exhaustion of the driver is conducive to the occurrence of accidents, and there is little doubt that the provision of steering boosters, carefully developed to meet all of the requirements of road operation and involving no hazards of their own, would add to the safety of road travel. The introduc-

This is the first of two articles showing the needs and developments to reduce the physical effort in steering. The second article will appear in an early issue of *Automotive Industries*



Sectional diagram of Bethlehem torque amplifier

A, shaft to which steering wheel is secured; B and C, clutch drums with gear teeth; D and E, clutch bands; F, arm on shaft A by which clutches are engaged; G, radial arm by which power is transmitted from clutches to worm shaft H.

tion of such steering servos would undoubtedly meet with the approval of the insurance authorities.

The only mechanical steering booster that has come to the attention of the writer is a device that was launched as the Bethlehem torque amplifier by the Bethlehem Steel Company in 1927. One of these devices fitted to a Stutz car was exhibited at the S. A. E. summer meeting that year by its inventor, H. W. Nieman.

This torque amplifier comprises two small drums with gear teeth on their outer circumference, which are positively driven in opposite directions at a slow speed by means of a universal-jointed shaft from the engine. Inside of each drum there is a friction-lined expanding band. One end of the band is anchored to an arm extending radially from the shaft carrying the steering worm, while the other is adapted to be moved away from the former, whereby the clutch band is expanded into driving contact with the drum, by a radial arm extending from the shaft carrying the steering wheel.

The two clutches are so arranged that one will be engaged by right-hand and the other by left-hand rotation of the steering wheel. The motion is transmitted to the worm shaft by the radial arm carrying the clutch band. A small pivoted member serves as an automatic adjustment, compensating for wear, etc., so that the friction bands are always at the proper tension, and no backlash can develop.

In external appearance the device is a small cylindrical casing on the steering column beneath the floorboards. From the driver's point of view, the steer-

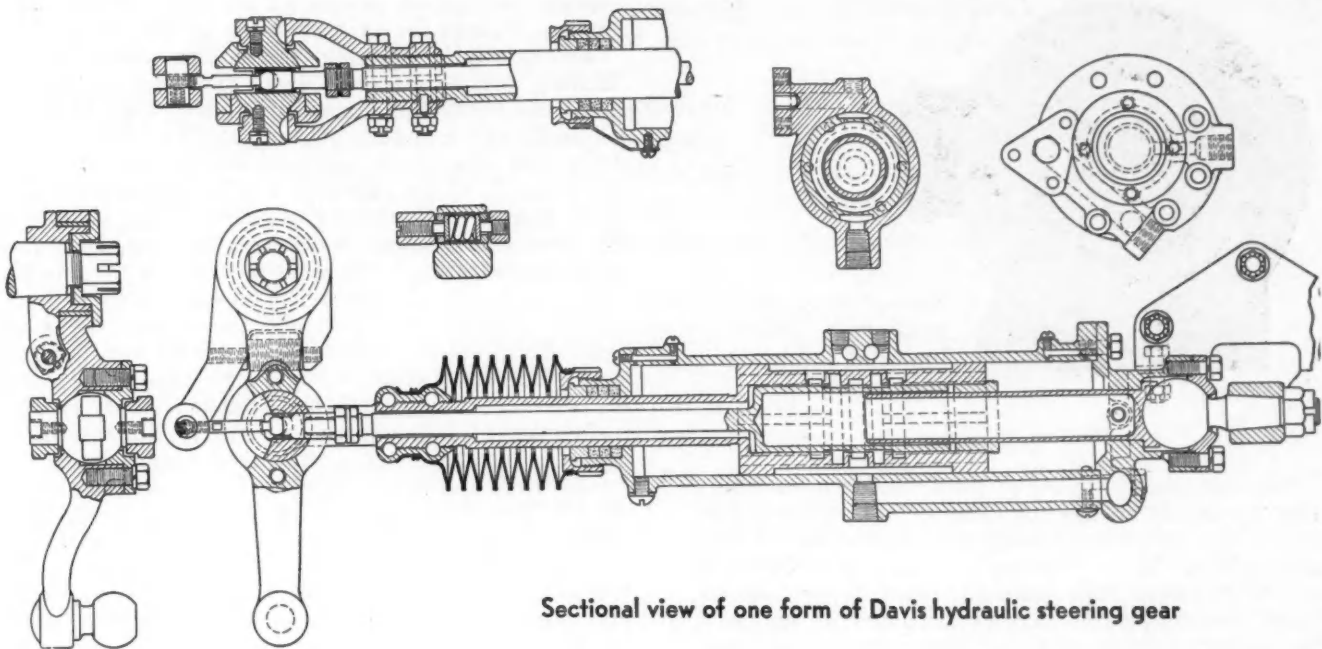
ing operation is not changed in any way except that the effort required is greatly lessened. An amplification of 1 to 10 was used in the device fitted to the Stutz, on which the ratio of the steering gear was reduced from the customary 16 to 1 to 6.7 to 1. It was felt, however, that for general application the ratio should be somewhat higher.

Connection to the engine can be effected in various ways, preferably by coupling the driving shaft to one of the engine accessories already geared to the crankshaft. This, of course, applies particularly to installation on cars already in service. The power required to operate the booster was said to be negligible. If the engine should "die" the driver would still have full control of the steering gear.

One of the pioneers in the development of power steering equipment is F. W. Davis, of Waltham, Mass. Mr. Davis at one time was chief engineer of the truck department of the Pierce-Arrow Motor Car Co., in which capacity he had the opportunity to study the difficulties involved in the steering of heavy vehicles. Four different models of the Davis steering gear have been built, all of them using the hydraulic principle of power transmission. The system comprises a small pump which is positively driven from the engine and which moves a liquid (engine oil) through a closed circuit at a rate depending on the speed of the engine. Combined with the steering mechanism is a double-ended cylinder containing a piston. The flow of the liquid moved by the pump is controlled by means of a valve which is actuated by the pull of the operator on the steering wheel.

The housing, the piston, and the valve are arranged concentric with each other, and the cylinder is closed at both ends so that there is a chamber in the housing on both sides of the piston. Both the piston and the valve are provided with a series of ports and passages which control the flow of the liquid. When the valve is in the neutral position, oil flows freely from the inlet connection of the housing through the inlet passages into both chambers and out through the outlet ports. There is then equality of pressure on both sides of the piston and the piston is held in whatever position it occupies in the cylinder. However, if the valve is moved slightly to one side of the neutral position, the resistance to flow into one of the chambers will decrease and that to flow into the other chamber increase, and as a result there will be more pressure on the head of the piston in the first chamber, so that the piston is being forced away from that end of the chamber by the fluid pressure. The piston is connected by a piston rod and ball joint to the steering arm, and the fluid pressure on the piston is thus transmitted to the steering arm, which is thereby urged in the same direction in which it turns under the influence of the driver's pull on the steering wheel.

The steering gear really has two steering arms, of which the shorter one is fixed to the transverse shaft of the gear while the longer one is free upon it. The longer steering arm is provided with a lug on one side

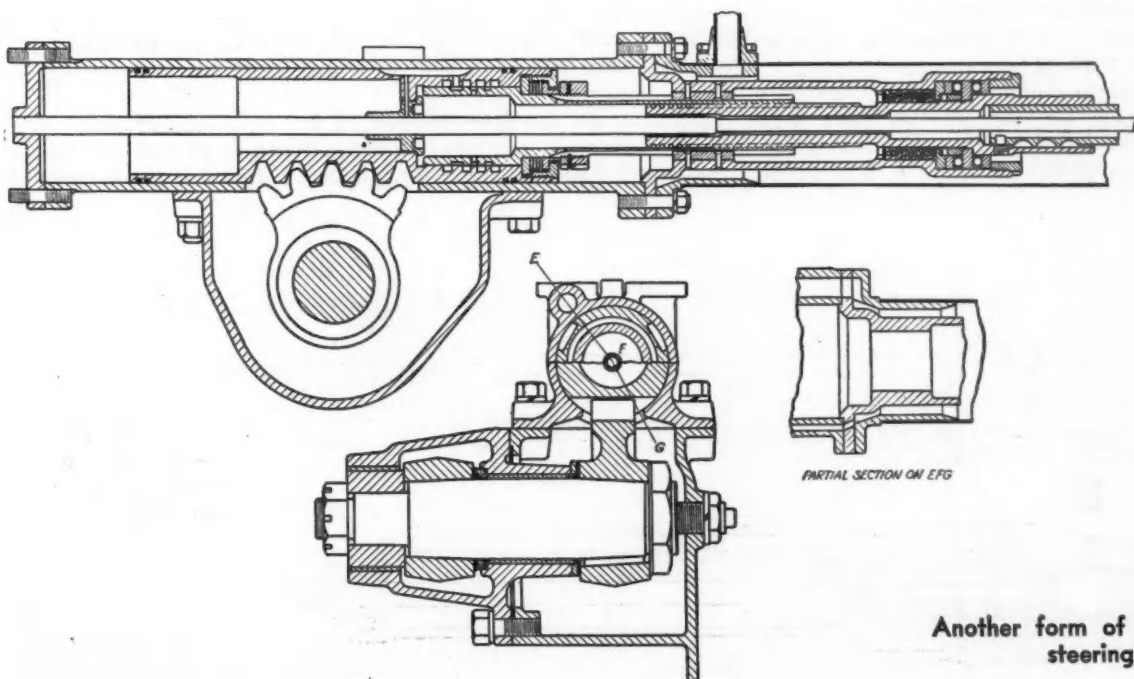


Sectional view of one form of Davis hydraulic steering gear

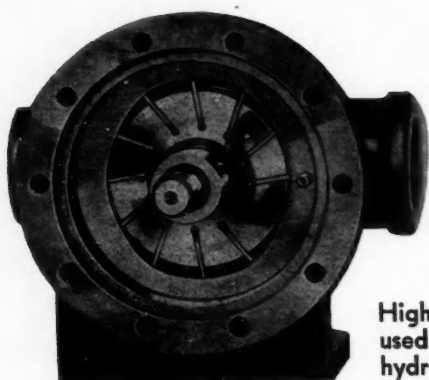
which extends into a slot on the other arm. The lug on the long arm is drilled out and contains a coiled spring, and there are set screws in the two prongs of the short arm on opposite sides of the lug, which bear against spring washers, the whole arrangement being such that the short steering arm carries the long arm along with it in its angular motion, but because of the spring cushion and a slight clearance between the lug on the long arm and the prongs of the short arm, one arm is capable of yielding slightly with relation to the other.

As shown by the drawing, the valve is connected to the free end of the short arm by a rigid link. Thus when the driver exerts a pull on the steering wheel in one direction or the other, any resulting motion of

the wheel is positively transmitted to the valve, but it may not result in a deflection of the front wheels because of the yielding connection between the short and the long steering arms, to the latter of which the drag link is connected. A motion of the valve in relation to the piston then causes fluid pressure to be exerted in the same direction as that in which the pull of the driver on the steering wheel tends to move the drag link. The greater the pull of the driver on the steering gear, the greater will be the displacement of the valve relative to the piston, the wider the inlet port opening to that chamber in which the greatest pressure is being exerted on the piston. The fluid pressure on the piston, of course, swings the front wheels around.



Another form of Davis hydraulic steering gear



High-pressure pump
used with Vickers
hydraulic steering
gear

For the peace of mind of the driver it is necessary that he should always feel that he has complete control of the direction in which the car travels and that there should be no "wander" of the front wheels, as occurs at times with steering gears of the conventional type having an excessive amount of backlash. In ordinary driving of a car with conventional steering gear, the moments of the reactions on the front wheels around the knuckle spindles are practically never equal, and the car tends to deviate from the direction for which the steering gear is set. The driver thus has to exert a constant slight pull on the steering wheel in order to keep the car headed in the direction in which he wants to go. This takes up the slack in the steering gear. The pull which it is necessary for the driver to exert varies with the inequality of the moments on the two front wheels around the knuckle axes, and he has a definite feel of the road way and a sense of directional stability.

In the earliest Davis steering gear no means for centering the valve were provided and the driver lacked the "directional stability" referred to in the foregoing. Various schemes were tried to remedy this defect and that finally adopted consists in the use of preloaded centering springs. This not only gave excellent directional stability and the proper "feel of the road," but also permitted of a self-righting effect being produced by the geometry of the steering linkage and the reversibility of the gear.

The arrangement of preloaded springs also reduced the necessity for making the valve ports very narrow, making it possible to reduce the back pressure on the pump and reducing the size of the valve ports. A further improvement due to the preloaded springs was the positive return of the valve parts to the central or

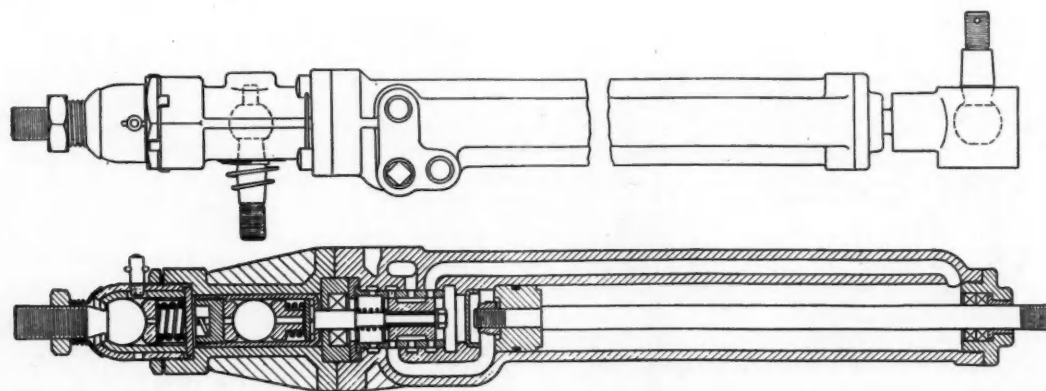
neutral position on release of the hand wheel. This further reduced the back pressure on the pump.

An hydraulic steering mechanism developed by Vickers, Inc., of Detroit, Mich., has been installed in numerous heavy vehicles, including two fleets of buses, one in Brooklyn and the other in Boston. The Vickers equipment, the writer understands, was evolved from the elements of an hydraulic feed mechanism for machine tools. In the design of this system the following four requirements were kept in view, according to the manufacturer: A servo-mechanism for steering gears must not strain the linkage excessively, must become effective without any appreciable lag after the steering wheel is set in motion, must not interfere with manual steering in case the vehicle is being towed, and, if hydraulically operated, must employ sufficiently high pressures to keep the dimensions of the cylinders, pipes, etc., within reasonable limits.

The Vickers system comprises a high-pressure pump of the eccentric type, of which an illustration is shown herewith. This pump is said to be capable of working under a pressure of 1000 lb. p. sq. in. continuously. Most truck and bus applications, however, are so designed that a pressure of 400 lb. p. sq. in. is never exceeded. The maximum pressure control valve is so set that slightly more power is available than is required to turn the wheels when the vehicle is standing on a dry, hard pavement. The availability of sufficient power is an aid in maneuvering the vehicle in close quarters, while limitation of the power tends to protect the linkage.

A sectional view of the hydraulic cylinder is shown in one of the illustrations. This cylinder contains a piston with rod, the rear end of which latter is anchored to the chassis frame by means of a ball stud and socket. Within the body of the hydraulic cylinder, forward of the cylinder proper, there is a piston valve, which is essentially of spool type. Oil from the pressure pump enters the valve chamber through ports at the center, and it is allowed to flow to one end of the cylinder or the other through series of ports at opposite ends of the chamber. The piston valve is connected to the socket of the steering arm, and when no turning effort is being exerted on the steering wheel, the valve is in its central position and both ends of the cylinder are shut off from communication with the pump. Under this condition a small pressure is said to be exerted on both sides of the hydraulic piston, which is evidently due to slight leakage of the valve.

At the forward end of the hydraulic cylinder body there is another ball stud, which is lodged in a socket formed in the cylinder body, and this stud connects



Side and sectional view of
Vickers power
steering unit

Increase in the size of commercial vehicles and increase in speed and decrease in tire-inflation pressures severely tax the strength of drivers in the steering of some of the units.

Of course a decrease in the actual pull on the steering wheel required can be effected by increasing the ratio of the steering gear, but this is only a partial solution of the problem, since it increases the wheel motion necessary in making, say, a right-angled turn, and the practical limit of development in this direction probably has been reached already.

The real solution seems to be the adoption of some form of power-operated steering gear or servo-steering mechanism. A number of inventors have been working on such devices for several years past, but the actual need for them seems to have dawned upon manufacturers and operating companies only during the past year.

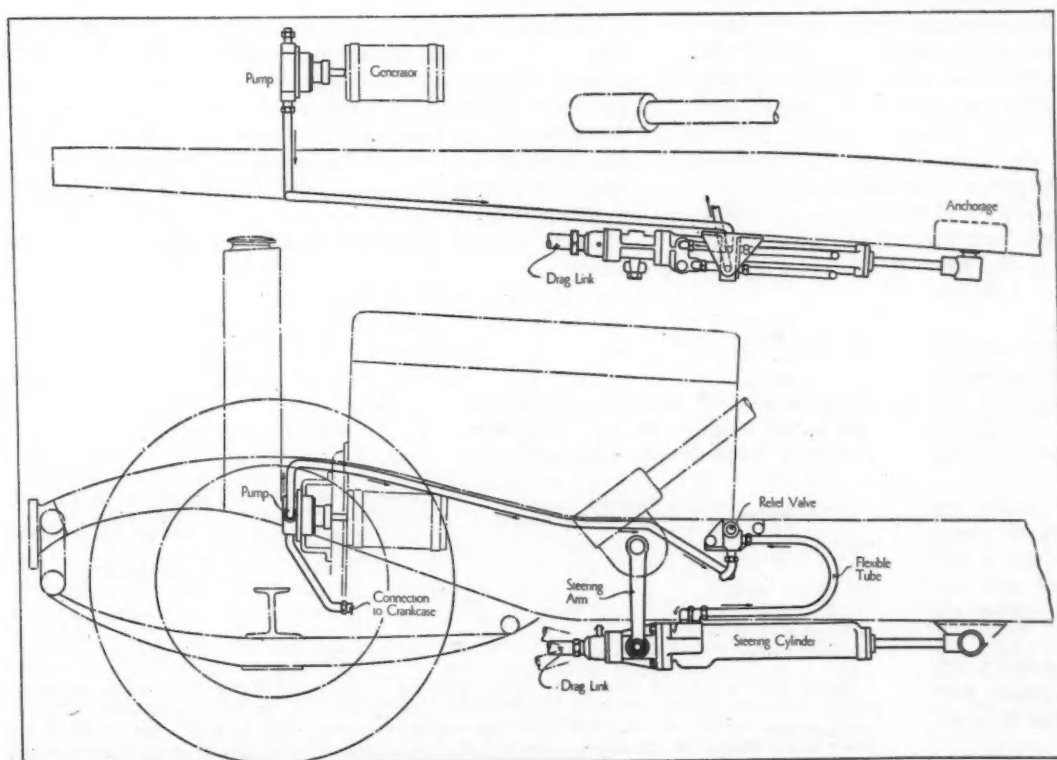
Today there are a number of fleets completely equipped with power steering devices; several specially heavy models of trucks and buses on the market come regularly equipped with such devices, and manufacturers have a variety of designs of steering boosters—mechanical, hydraulic and pneumatic—to choose from.

to the drag link. A pull on the steering wheel in one direction or the other, which is transmitted through the steering gear to the steering arm, causes a slight axial displacement of the valve, with the result that one end of the hydraulic cylinder is opened to the source of supply of the fluid, the inlet connection, and the other to the discharge connection. Naturally there is an increase in pressure in that end of the cylinder connected to the source of supply, and the piston within the cylinder is moved toward the other end. It is claimed that the increase in pressure on one side of the piston and the decrease on the other side are very gradual. It takes only 0.020 in. movement of the steering arm to make the hydraulic pressure effective, and the "feel" of the steering wheel is said to be similar to that experienced when the front axle is jacked up and the wheels are then swung around. It will be

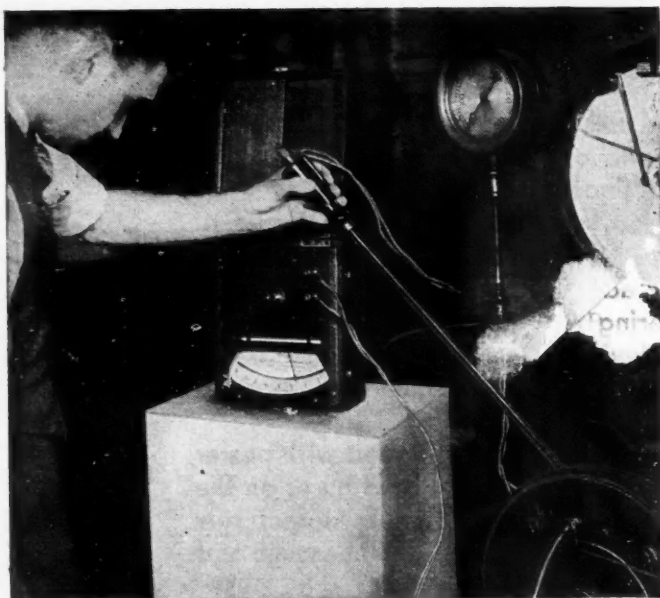
noticed that the socket surrounding the ball on the steering arm has only a very limited motion within the cylinder body, and in case of the unlikely event of failure of the mechanism the vehicle can still be steered by hand. Suitable valving is provided so that the car can be steered manually at any time the engine is not running. This valving is automatic.

A reservoir for the storage of the operating fluid is required, and in some cases a separate reservoir has been installed for the purpose. In other cases the crankcase oil is used, to eliminate the need for a separate tank, and the oil is then taken from the crankcase and returned to it continuously. This arrangement has been used by the Goodyear Tire & Rubber Company on a number of test cars used in the development of air wheels.

(To be concluded December 17)



**Installation of
Vickers hydraulic steering system**



Making the test for the heat conductivity of the new Grey-Rock Eagle brake-lining
— For Results see Table 2

DO you prefer your brake lining molded or woven? Whatever your preference, you may be interested in a new brand that is said to combine the virtues of both.

By means of a special pretreating process, the United States Asbestos Division of Raybestos-Manhattan, Inc., of Manheim, Pa., has produced a flexible, combination woven-molded brake lining, known as Grey-Rock Eagle. It is completely aged when it leaves the factory. It is shipped in rolls and remains flexible on the shelf.

Because of the unusual nature and characteristics of this brake lining we visited the factory and saw how the product is made. We saw the lining grow from virgin rock asbestos to the yarn, to the weaving of the strap with its first pretreatment, then the second pretreatment, and finally grinding to size, branding and inspection.

Then in perspective we sensed one vital element behind every step in the process—Quality Control.

Quality control produces a selective range of coefficient of friction, uniform structure, and uniform dimensions. Obviously, these are the very keys to the braking problem.

Perhaps a better impression of what this quality control really means may be gained from the following excerpt of a recent report on a series of drum scoring tests:

"This comparison is made on the basis of an accelerated test, used by a prominent car manufacturer. The figures shown are the averages of a large number of tests.

Actual tests were made in all cases from speed of 50 miles per hour and consisted of the following sequence—

Pretreatment of Brake Lining

5 stops at rate of one per mile
5 stops at rate of one per 0.4 mile
This cycle repeated.

On one standard woven lining 400 stops were secured before scoring. On another 800 stops were secured before scoring.

Grey-Rock Eagle ran 1300 stops without scoring, test then discontinued."

Pretreating is probably the most important operation from the point of view of the engineer. It consists of two distinct steps, the first during weaving; the second after weaving. In weaving, certain strands of warp yarn principally those going into the outer layers, pass through a trough filled with the plastic impregnating compound and pick up a generous coating. The compound is accurately controlled as to composition, viscosity, etc., while the movement of the yarn is controlled as to speed and tension.

Just before the yarns reach the loom, a mechanical movement rapidly passes a row of untreated yarn up through the coated layer so that a good deal of the coating thus is transferred. By this means practically every strand of yarn is coated with the plastic compound thus carrying the material right into the heart of the lining.

We might mention that the compound is said to be similar to the material usually used in the making of molded linings except that there is no rubber in it, since flexibility is inherent in a woven belt. One of the ingredients of this compound is a metallic powder which helps control the coefficient of friction. Accordingly its proportion in any mix depends upon definite specifications.

After leaving the looms, the lining enters the second

TABLE I

Comparison of specific gravity of grey-rock eagle with a first quality asbestos brake lining, standard type

Thickness	Specific Gravity Grey-Rock Eagle	Specific Gravity Standard Woven Brake Lining	Increase in Specific Gravity, due to Pretreatment process.
$\frac{5}{32}$ "	1.82	1.63	11.6%
$\frac{3}{16}$ "	1.93	1.62	19.2%
$\frac{1}{4}$ " (sizes under $3 \times \frac{1}{4}$ ")	1.80	1.55	16.1%
$\frac{1}{4}$ " (sizes $3 \times \frac{1}{4}$ and over)	2.12	1.55	36.3%

These figures are the average of tests on a large number of widths of the two different types of lining in the various thicknesses. Tests did not include sizes over $\frac{1}{4}$ ", but comparison would be very close to the comparison on sizes $3 \times \frac{1}{4}$ " and over, since Grey-Rock Eagle, in all sizes over $3 \times \frac{1}{4}$ ", is made only in heavy duty construction.

of Woven-Molded Control Quality

by Joseph Geschelin

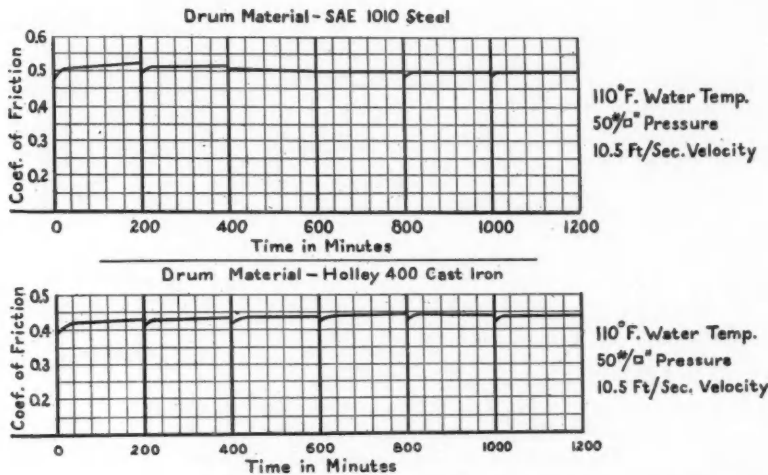


Fig. 1—Showing the results of tests to determine the value and constancy of coefficient of friction of Grey-Rock using steel and cast iron drums.

pretreating stage starting with an initial bake which thoroughly removes all moisture and leaves the lining in a uniformly dry condition. Then the material passes to a series of dips in impregnating tanks ending in a final bake.

Linings now are completely treated with the molding compound and ready for the final steps.

Then comes the most important mechanical operation having to do with control—surface grinding to size. This process (covered by patent) consists in passing the lining first between two horizontally opposed grinding wheels which smooth the front and back surfaces and cut the thickness to the required limits; then into a second machine in which the edges are trimmed off to get the desired width. Thus the frictional area as well as thickness are held to the precise limits asked for by the brake engineer.

We mentioned earlier that the coefficient of friction may be varied to suit individual needs. This results from a combination of two elements. The first comes from varying the proportions of the metallic powder ingredient of the plastic compound; the second depends upon the kind of wire used in spinning the yarn. Basically, Grey-Rock yarn is reinforced throughout with brass wire. However, if a low coefficient of friction is desired zinc wire is used for the strands in the friction surface while brass wire will go through to the back.

Fig. 1 shows the results of a long series of tests to determine the value and constancy of coefficient of friction of Grey-Rock, using steel and cast iron drums.

Pretreating in this fashion is claimed to produce a dense structure, free of voids, particularly at the work-

ing surface. To substantiate this claim a careful comparison has been made of the specific gravity of standard sections of Grey-Rock and a first quality asbestos lining of the regular type. The result as shown in table 1 indicates that the structure of Grey-Rock is from 12 to 36 per cent more dense depending upon the thickness.

Because of this compactness, the new lining is found to be practically impervious to the penetration or absorption of water and oil. Naturally, when oil or water is present on the surface, braking will be affected, but it returns to normal when the effect wears off.

Compactness-absence of voids also tends to reduce drum scoring because there are no spaces in the surface to pick up particles of metal or dirt. Longer life is expected for the same reason.

In some experiments conducted by the manufacturers, the new lining was found to conduct heat much more rapidly than other linings tested. In this test, the braking surface was kept at a constant temperature of 650 deg. F., while the temperature of the lining at points next to the shoe was measured by a pyrometer at regular intervals. It required only 75 seconds for the shoe side of the lining to reach the same temperature as the braking surface. Samples of other types of linings tested in the same manner required longer periods of time. Quantitative results appear in table 2.

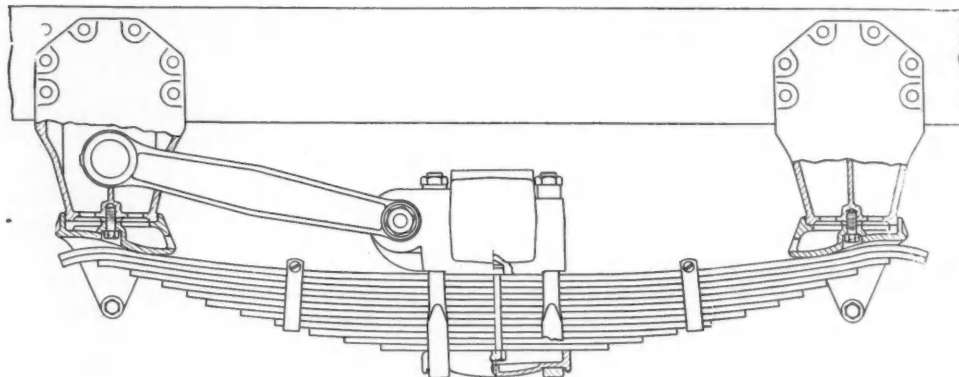
The high degree of heat transference is best explained by the metallic nature of the structure of the lining since it contains not only the brass bound yarn, but also the metallic powder.

TABLE 2

Comparison of rate of heating dissipation of various types of brake linings

Time in seconds	New Grey-Rock Eagle	Woven A	Woven B	Woven Non-Metallic	Molded A	Molded B	Folded and molded
10	175	55	65	50
20	390	155	205	145	70	50	100
30	520	230	315	200	140	140	155
40	560	300	395	275	205	200	215
50	610	360	455	320	250	255	265
60	635	410	515	385	290	310	315
75	Complete Dissipation	460	565	440	340	345	365
90		510	595	470	370	365	400

Underslung Rear Spring Mounted Direct to Frame on GMT Model



Springs are 6 in. wide, with 14 one-half in. leaves. Instead of being shackled they contact a cam-shaped block at each end

WITH the announcement of two new models, the T-110 4-wheeler and the T-130 6-wheeler, the line of trucks offered by General Motors Truck Co. is extended into a still higher range, the T-110 carrying a gross rating of 40,000 lb. and the T-130 of 50,000.

The new models follow the design of the T-85 and T-95 respectively, but have larger engines, heavier frames and axles, larger tires, etc. While several types of engines are available in these trucks, standard equipment is the GMT-616 cu. in., valve-in-head type, having the same characteristics of design as the engine in the T-85. Engine features include a replaceable semi-steel sleeve in each cylinder bore; aluminum crankcases; cylinder heads in two parts for easier servicing; counterweighted crankshafts with harmonic balancers; pressure lubrication of piston pins; aluminum-alloy pistons fitted for close clearance; automatic hydraulic valve adjusting mechanism for zero tappet clearance eliminating noise, reducing wear and decreasing the attention necessary; tulip-type exhaust valves; removable stellite-faced valve-seat inserts, a drive for water pump through a spring to prevent damage in case of seizure; dual V-belt fan drive; downdraft duplex carburetor with heavy-duty triplex air cleaner; three-point rubber engine mounting; oil cooler, cleanable type oil filter; two-stage oil pump (one unit for the cooler and one for bearing lubrication); three-piece exhaust manifold to allow free expansion; non-jamming starting motor, etc.

Both of the new models have heavy-duty, double disk-type clutches and a four-speed heavy-duty truck-type transmission, with two power take-off openings and all shafts carried on ball or roller bearings. An auxiliary transmission is located amidships to provide four speeds forward and three reverse.

Frames are fitted with stress absorbers in the form of channel reinforcements, etc. Front springs are shackled at the front and have double-wrapped eyes at the rear. The rear spring on the T-130 is of the same type as on the T-95, with the ends sliding in block-type shackles, provided with oil reservoirs for proper lubrication. On the T-110 a single set of springs is used without auxiliaries, but of novel design. The spring is underslung and mounted directly below the frame channel. Instead of being shackled, the spring ends contact a cam-shaped block at each end in such a manner that under light loads, the effective length of the spring is approximately 65 in. As the load increases and the spring deflects more, the effective length of the spring is reduced to a minimum of 50 in. in the metal-to-metal position. These springs are 6 in. wide and have 14 one-half inch leaves. These blocks are made in such a manner that they are replaceable on the truck. Torque rods take both torque and propulsion.

On the T-110, rear axles are of the double-reduction type, while the T-130 rear axles are worm gear SW460 series.

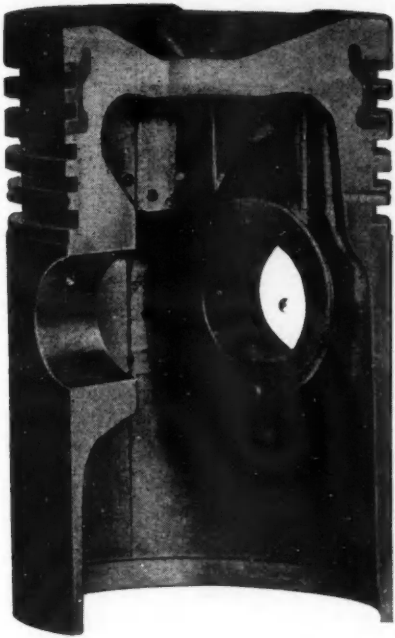


Fig. 1 — Section through Elektronmetall piston with ring carrier of alloy cast iron

GERMAN experience with automotive Diesel engines equipped with light-alloy pistons is said to have shown that the wear on piston rings and ring grooves is comparatively high, and that pistons and rings must be replaced sooner than with comparable carburetor-type engines. In an article on "The Economic Importance of the Diesel Engine for Motor Transit," in the periodical *Verkehrstechnik* of June 25, 1932, the following statement was made on this subject:

"In view of the long life (60,000 to 80,000 miles) of gray-iron pistons in carburetor engines, it seems desirable that more attention should be paid in future to an increase in the life of light-alloy pistons, the use of which in Diesel engines is unfortunately unavoidable."

In the September 15, 1932, issue of the same periodical, Director G. Quarg, of the Berlin Transit Company, states that "at present the life of crank-train parts (of Diesel engines) is only one-half as great on the average as in carburetor engines."

To solve this problem of excessive wear on rings and ring grooves in light-alloy pistons, Elektronmetall Company of Stuttgart-Cannstatt, the German manufacturer of Bohnalite pistons, has developed a new design in which a ring carrier of special (alloy) iron is cast in the upper part of the cylindrical wall of the piston and has the grooves for the two topmost rings cut in it. A sectional view of the piston is shown in Fig. 1.

In the course of development of the new piston, wear measurements were made on the pistons and rings of a Mercedes-Benz Diesel engine fitted to a bus in the service of the Duisburg-Hamborn Transport Company, after the vehicle had covered a mileage of 63,500. The engine has six cylinders of 4.14 in. bore. Piston No. 1 was of Bohnalite alloy, with solid skirt, and had a ring carrier of Beryllium bronze. Pistons

Alloy Ring Carrier Cast In Light Piston Resists Wear, Diesel Tests Show

63,500-mile run developed relatively small axial wear in Mercedes-Benz bus tested in Germany

Nos. 2 to 6 were of a high-silicon aluminum alloy (corresponding to our Lo-Ex), with solid skirt and with a ring carrier of alloy cast iron. The engine was fitted with both an air cleaner and an oil filter.

Piston No. 1 of the engine was provided with a ring carrier of beryllium bronze, while the other five pistons had ring carriers of alloy cast iron. All rings were of the individually-cast type. Axial wear on both the rings and the ring grooves is charted in Fig. 2, the height of the bars above the horizontal line denoting

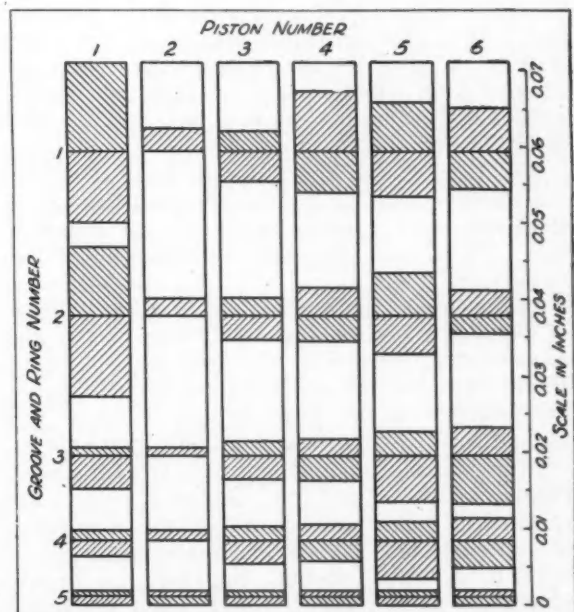


Fig. 2 — Wear of rings and grooves. Height of shaded section above center line represents wear on the sides of the groove; height below center line, wear on sides of ring. These wear "bars" are drawn to the scale shown on the right.

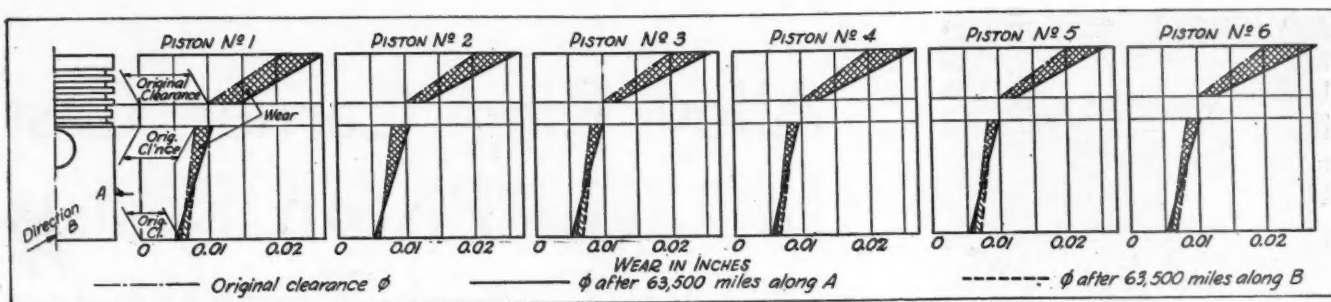


Fig. 3—Wear on piston skirts

the wear on the sides of the groove, and that of the bars below the horizontal dividing line, the wear on the sides of the rings.

The wear of the piston rings in the axial direction is relatively small, considering the mileage of 63,500. For the top ring it averages 0.0052 in. The radial wear of the rings was greatest in each case on the top ring; the increase in the gap averaged 0.120 in., corresponding to a decrease of the diameter of 0.040 in. The great radial wear of the rings is due to the high gas pressures occurring in the Diesel engine, as compared with those in carburetor engines. It is impossible to prevent the burning gases from getting in behind the piston rings and pressing them with great force against the cylinder wall. Since the temperature of the piston also is somewhat greater than that of pistons in carburetor engines, the lubricating conditions of the top ring are somewhat worse in the Diesel engine. Friction without proper lubrication necessarily leads to wear.

The pressure of the rings decreased materially, corresponding to the decrease in the radial thickness of the rings by wear, and the reduction was by far the greatest in the case of the top ring. The average pressure of the top rings at the end of the test period was 1.54 lb., as compared with an initial pressure of 3.08 lb. With such a low pressure the ring is incapable of giving an effective seal, so that the topmost ring gradually became useless as a seal and the work had to be done by the other rings.

The hardness of the rings in general were within the limits stipulated by the specifications, viz., 83-91 Rockwell, with a pressure of 100 kg. and a 1/16-in. ball. There was, therefore, no softening of the rings in service.

In the case of piston No. 1, with a hard ring carrier of beryllium bronze, the axial wear of the ring was somewhat greater than with pistons Nos. 2-6. This shows that the wear resistance of individually cast piston rings on beryllium bronze is not as great as that of the same rings on hard alloy cast iron.

In the cases of pistons Nos. 2 to 6, with a hard ring-carrier of special cast iron, the ring grooves stood up excellently. The axial wear of the topmost groove amounted to only 0.0048 in., consequently the pistons could be continued in use, for, as a rule, recutting of ring grooves is necessary only when the axial wear amounts to about 0.012 in.

There was no loosening of the hard ring carrier in the piston. Both the body of the piston and the ring carrier have the same coefficient of expansion, which makes this construction practical.

It is worth noting that both the axial wear of the ring grooves and the axial wear of the rings is some-

what greater in pistons Nos. 4 to 6 than in pistons Nos. 2 and 3. This observation has been made repeatedly on Daimler-Benz OM5 engines. Even with ordinary Nelson-Bohnalite pistons the wear of rings and grooves is considerably smaller for pistons 1-3 than for pistons 4-6. This is related to the fact that cylinders Nos. 1-3 are periodically cut out. Piston No. 1 cannot be considered in this connection, for the reason that the ring carrier is made of an entirely different material (beryllium bronze instead of cast iron).

Piston No. 1, with hard ring carrier of beryllium bronze, gave much poorer results, the axial wear of the ring grooves amounting to 0.008 in. When this is combined with the greater wear of the ring, the play between ring and groove amounts to about 0.020 in., as compared with about 0.010 in. for pistons Nos. 2-6. This result also corresponds to wear tests on beryllium bronze on cast iron which have been carried out in the meantime. Therefore, beryllium bronze as now offered in the market cannot be regarded as an improvement on alloy cast iron for ring carriers.

The wear of the piston skirt is shown in Fig. 3. It is quite small, as is usual in the case of piston skirts. The values in this case are only 0.0008 to 0.0020 in., and the figure in part represent out-of-roundness due to assembly and disassembly, rather than real wear.

Some of the grinder marks due to a manufacturing operation are still visible on the skirt. This also shows that what is involved is a small deformation rather than actual wear.

Wear on the upper part of the piston wall is somewhat greater, owing to the less favorable conditions of lubrication for the ring belt, as compared with the skirt. But neither wear of the piston skirt nor that of the ring belt had any influence on the serviceability of the pistons. All pistons showed a good wearing surface, which reflects good care and frequent renewal of the oil supply.

All of the six piston heads showed a slight coating of carbon on the outside. There were no signs of fusion or damage of any kind to the piston head as a result of the fuel spray impinging upon it constantly in the same spot.

During production, the pistons were subjected to compression on the head with a steel ball, in order to detect any possible porous places immediately below the surface. The formation of oil coke on the inside of the piston head was somewhat greater in pistons 2-6 than in piston No. 1. This is a sign that the temperature is somewhat higher. The oil-return holes in pistons Nos. 2-6 were more choked with carbon than those in piston No. 1. This is explained by the somewhat lower thermal conductivity of the silicon alloy No. 245 as compared with Bohnalite. As long as there

is no "burning through" of the piston, alloy No. 245 can be used for Diesel engine pistons without hesitation, notwithstanding the formation of oil coke. In engines in which the fuel is injected from the side there is no danger of "burning through," as the thermal stresses in the piston head are then fairly uniform. In types where the piston heads tend to burn through, this can be prevented by the provision of a head plate, chill-cast into the piston head at the center, of the same material as that of which the hard ring carriers are made.

The fit of the piston pin in the bore of the bosses was still good. The wear in the bores was negligible, as was that on the pins themselves. Wear on the crankpins in the piston bosses and in the bushing in the small end of the connecting rod was approximately equal.

From the results of the tests the following conclusions are drawn:

On piston No. 1, a Bohnalite casting with a hard ring carrier of beryllium alloy, ring grooves Nos. 1 and 2 should be recut. In the case of pistons 2-6, of

alloy No. 245, with solid skirt and hard ring carrier of special cast iron, the wear of the ring grooves and piston skirt was so slight that the pistons could be provided with new piston rings without machine work of any kind being done on them. It is assumed here that the cylinder bore wear does not exceed the permissible limit of about 0.012 in. Measurements of the cylinder bore, therefore, are necessary for a final decision. In any case, it is permissible to figure on much greater mileages with pistons of this type than that obtained in this particular case, if the piston rings are replaced as the oil consumption gradually increases. The very slow wear of the ring grooves, moreover, permits of recutting the grooves to the next larger size. Besides, it is possible, if the cylinders have worn too much, to place these slightly worn pistons in new cylinders—a practice that has been adopted by several large transit concerns (Berlin Transit Company, London General Omnibus Company, etc.). Such companies, which have in service a large number of vehicles of the same manufacture, use either new cylinder liners or order new cylinders from the manufacturers.

Use of Aluminum for Cylinder Heads Eliminates Excessive Dead Weight

WITH the ever increasing desire for greater engine power and higher compression ratios as a means of obtaining it, the automotive industry has manifested considerable interest in the use of aluminum for cylinder heads. Graham-Paige has already adopted a light alloy head for its sixes and eights, while Hudson-Essex has turned to aluminum for the cylinder heads of its de luxe models. A number of other motor-car manufacturers are actively engaged in tests on the aluminum cylinder head, and from present indications, the light-metal heads will be more extensively used in the automobile of the future.

Aside from the economies resulting from the lower cost of machining aluminum, cylinder heads cast in this metal possess certain characteristics which improve their functional behavior. The metal has a high heat conductivity, which makes possible increased power output and greater latitude in the design of the head, while its light weight effects a material saving in the weight of the engine as a whole.

The heat conductivity of aluminum is several times as great as that of the metal now mostly used for cylinder heads. As a result of the more nearly even heat distribution in the aluminum head, higher compression ratios can be employed, and the power of the engine increased anywhere from 5 to 15 per cent. Since this increase in power results solely from a higher thermal efficiency, it is obtained without added operating cost. The increase in power, of course, is reflected in improved performance, greater speed and acceleration.

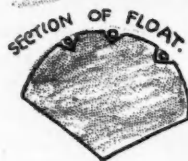
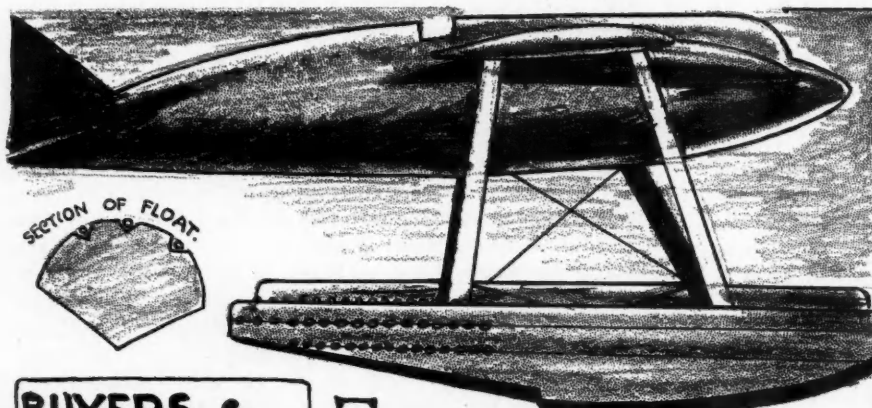
The use of aluminum minimizes certain difficulties inherent in cylinder-head design. Heavy metal sections are essential for stud bosses and spark plugs, while intricate cored passages must be provided for

introducing, circulating and carrying off the water. If the valves are in the head, the problems become all the more difficult, and very little can be done from the design standpoint. The head may be full of hot spots and cold spots, as a result of thin and thick sections in the casting, and the hot spots naturally place a limit upon the compression ratio that can be satisfactorily used in the engine. The same difficulties of design arise in connection with the aluminum cylinder head, but because of the relatively high thermal conductivity of aluminum, the temperature differences between adjacent sections are greatly reduced, and higher compression ratios can be used.

The benefits to be derived from the elimination of excessive dead weight are well known. The low specific gravity of aluminum makes possible a saving of between 50 and 60 per cent on the weight of the cylinder head.

Aluminum cylinder heads may be of the one-piece or two-piece type. Generally speaking the one-piece aluminum head is similar in construction to the conventional iron head. It may be cast in sand or by the semi-permanent-mold process with all water passages cored out. The two-piece head consists of a permanent-mold casting of aluminum with a cast-iron cover. The permanent-mold casting carries the combustion-chamber shapes on one side and the bosses, ribs, etc., on the other. This piece is assembled with the cast-iron cover to form the cooling water chamber and then the assembled unit is attached to the block in the regular manner, or the permanent-mold casting of aluminum may be attached to the block in the usual way and then covered with the iron casting. There is said to be little choice between the two designs from the viewpoint of operating efficiency.

Automotive Oddities—By Pete Keenan



**BUYERS &
CELLERS
USED AUTOMOBILES.**

② Sign in Maryland.

**SILVERED SUGAR BALLS USED ON
CAKES, WERE USED AS RIVET HEADS
ON THE S-5. BRITISH SCHNEIDER
TROPHY RACING PLANE.**



**THIS 1919 CAR WAS DRIVEN
AN AVERAGE OF 250 MILES A DAY FOR 5½
YEARS STEADY 500,000 IN ALL.**

**LOW PRESSURE RUBBER TIRES
ARE NOW MADE
FOR BABY
CARRIAGES.**



**DONA
LUIZA
LUESMA.**

**IS THE
PACKARD DISTRIBUTOR IN SPAIN**



Write us if you
know an Oddity.

The NEWS TRAILER

Howard E. Coffin has come out of retirement—into textiles as head of the Hunter Mfg. & Commission Co., one of the largest sales organizations in the world. A founder of Hudson, he is still a member of the board, but retired from executive activity in 1927.

A chain of aviation landing fields from coast to coast across Canada is being planned by the Dominion's Department of National Defense, and survey parties are now at work establishing the sites.

Aircraft engineers serving in his Britannic Majesty's navy feel somewhat shaky these days, what with the spirit of educational reform flying mast-high and just under the Union Jack.

Their Lordships of the Admiralty are testing candidates for promotion with such questions as "the colors and alternate names of crane's bill, cuckoo

flower, ragged robin, monk's hood and toad flax"—bits of information which may be priceless in some walks of life, but hardly important to men whose first function would seem to be coordinating the air fleet with the floating fortresses of which the Empire is so proud.

Botany, ornithology, entomology and zoology seem to have little place 'tween steel decks, although we do recall tall stories of sea-going mascots endowed with rare intuition—more a matter of superstition than one of the sciences.

Jolly Ol' Parliament passed a law in 1896, permitting cars to travel faster than 2 m.p.h., and abolished the law requiring a man to proceed in front of motor vehicles with a red flag, so the motoring inhabitants of the city celebrate annually the "emanicipation of the motor car."

This year, Sir Malcolm Campbell drove a '04 Sunbeam in the "parade of crocks" as part of the hilarity.

NEWS

General Motors Sales Reach \$74,575,864

Third Quarter Net Compares With Over \$168,000,000 of Year Ago

NEW YORK, Dec. 5—Net sales of the General Motors Corp. in the third quarter of this year amounted to \$74,575,864, compared with \$168,494,620 in the corresponding quarter of last year, according to the report of the corporation covering operations for the three months ended on Sept. 30.

For the first nine months of this year, net sales totaled \$371,374,398, against \$692,688,152 in the same period of 1931.

As revealed in its preliminary statement, the corporation in the third quarter had a consolidated net loss of \$4,464,229, in contrast with a net income of \$13,333,214 in the same quarter last year, which was equal, after preferred dividend requirements, to 25 cents a share on the common stock then outstanding.

In the first nine months of this year the company had a net income of \$10,555,175, equivalent after preferred dividend requirements to 8 cents a share on the common stock.

For the first nine months of 1931 it reported a net income of \$97,455,390, or \$2.08 a common share.

The consolidated balance sheet of the corporation as of Sept. 30 shows cash, United States Government and other marketable securities totaling \$209,098,832, compared with \$205,029,119 on Dec. 31, 1931, and \$264,107,166 on Sept. 30, 1931. Current assets were \$290,907,152, against \$358,502,579 on Dec. 31, last, while total current liabilities were \$50,495,513, against \$84,586,656, leaving net working capital of \$240,411,639 on Sept. 30, as compared with \$273,915,923 on Dec. 31, 1931.

Chrysler Plants To Rehire 6000

DETROIT, Dec. 5—Between now and mid-December working forces in the Chrysler plants here are to be

augmented by the recall of 6000 employees, K. T. Keller, president and general manager of Dodge Brothers Corporation, said today, following a conference with Walter P. Chrysler, president of Chrysler Corp., who returned to New York yesterday. According to Mr. Keller, the present force totals 22,000. It has been stepped up from 15,000 in the last three weeks.

Mr. Keller made it plain that only former employees are being taken back and notices are being sent to their homes. No new ones are being taken on at the employment offices.

61,216 Vehicles Made in November

Gain of 18 Per Cent Over October Production Reported

By N.A.C.C.

NEW YORK, Dec. 7—November production of motor vehicles showed a gain of 18 per cent over the preceding months, according to a report made at the Directors' meeting of the National Automobile Chamber of Commerce today.

The report showed an estimated production for the industry of 61,216 units.

The output was 12.8 per cent under that for the corresponding month a year ago. Production for the year to date was estimated at 1,323,652 units or 43.6 per cent under last year's production for the same period.

Willys May Use Floating Power

TOLEDO, Dec. 6—Possibility of use of floating power in the new line of the Willys-Overland Co. was seen here today in an announcement by Chrysler Motor Corp. that the local company is the first licensed to use the system.

The mountings for Willys-Overland will be furnished through Amplex Manufacturing Co., Chrysler subsidiary. Officials would not comment on announcement.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, Dec. 8—General trade last week showed the slackness that is usual during inventory period when buying is held at a minimum. Collections remained slow. The holiday trade so far has not measured up to that a year ago.

NOVEMBER SALES OFF

According to the Federal Reserve Bank of New York, available data relating to the distribution of goods and general business during the first half of November indicate a slight decline from the October levels.

FREIGHT LOADINGS

Railway freight loadings during the week ended November 19 totaled 575,851 cars, which marks an increase of 38,758 cars above those during the preceding week, but a decrease of 77,652 cars below those a year ago and a decrease of 203,901 cars below those two years ago.

GROSS EARNINGS DOWN

A report of the Federal Reserve Bank of New York states that earnings of 300 industrial and mercantile concerns during the third quarter of this year show an aggregate deficit. This marks the first quarterly period since the depression began in which expenses and fixed charges have exceeded gross earnings.

ELECTRIC PRODUCTION OFF

Production of electricity by the electric light and power industry of the United States during the week ended November 26 was 7.8 per cent below that in the corresponding period last year.

FARM PRICES LOWER

According to the Department of Agriculture, price declines during the month ended November 15 brought the farm price index down to 54 per cent of the pre-war level, as against 56 per cent on October 15 and 71 per cent a year ago.

OIL PRODUCTION

Average daily crude oil production during the week ended November 26 amounted to 2,099,250 barrels, as against 2,111,100 barrels for the preceding week and 2,420,100 barrels a year ago.

FISHER'S INDEX LOWER

Professor Fisher's index of wholesale commodity prices during the week ended December 3 stood at 60.2, as against 60.5 the week before and 60.4 two weeks before.

Bank debts to individual accounts outside of New York City during the week ended November 30 were 34 per cent below those a year ago.

STOCK MARKET

The stock market during the first part of last week showed a sagging tendency under the influence of several unfavorable developments, most notably the continued decline in sterling exchange.

A good rally on Thursday was followed by renewed weakness on Friday. Most issues showed moderate net losses for the week.

The volume of trading was small until the bad break occurred on Wednesday.

FEDERAL RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended November 30 showed very little change. Holdings of discounted bills increased about \$1,000,000, while holdings of bills bought in the open market and Government securities remained unchanged.

The reserve ratio on November 30 was 62.6 per cent, as against 62.7 per cent a week earlier, and 62.4 per cent two weeks earlier.

General Motors Stocks Lower by 46,246 Units

Corporation Enters 1933 With New Low of Cars in Dealers' Hands

NEW YORK, Dec. 8—Alfred P. Sloan, Jr., president, General Motors Corp., announced today a decrease of 46,246 units in stocks of new cars in the field during the twelve months ended Nov. 30. This means that the various car divisions of General Motors are now going into the production of their 1933 models with the advantage of the lowest level of unsold stocks in dealer hands ever recorded since comparable statistics were first prepared on such stocks in 1922.

The unsold stocks of used cars also were lowered approximately 41 per cent during the 12 months. Used car stocks were lower on Nov. 30 than for any similar date since comparable records were first compiled in 1926.

Stocks of new and used cars in foreign countries were reduced similarly.

"This is an unprecedented condition and means that, assuming a consumer demand no greater next year than in the past year, General Motors sales to dealers would have to be at least 46,246 units more than in the past twelve months simply to maintain the dealers' present low level of inventories," Mr. Sloan said.

"Under these circumstances, it is obvious that even on a 1933 volume of sales to consumers identical to that in 1932, General Motors would be required to expand its employment and increase its purchases of raw materials. Any 1933 pickup in consumer demand over 1932 would thus additionally stimulate employment and be felt as well in industries from which raw materials are obtained.

"I believe that this liquid condition applies pretty generally to the whole automobile industry which, as a result, will enter 1933 in a healthy condition from an inventory standpoint."

Sales of General Motors cars to consumers in the United States last month totalled 12,780 as against 26,941 in October, and 34,673 in November a year ago.

November sales of General Motors cars to dealers in the United States totalled 2,405 as against 5,810 in October and 23,716 in November a year ago.

November sales of General Motors cars to dealers in the United States and Canada, together with shipments overseas, totalled 5,781 as against 10,924 in October and 29,359 in November a year ago.

A. S. M. E. Speakers Give Factory Process Papers

NEW YORK, Dec. 5—The annual meeting of the American Society of Mechanical Engineers opened this

morning with interesting topics of automotive interest included in the program of the four-day session.

Among others, reports and papers on metal cutting were to be read by O. W. Boston and C. J. Oxford (Progress Report No. 4, Cutting of Metals) and T. G. Digges was scheduled to read a paper on the Effect of Lathe Cutting Conditions on the Hardness of Carbon and Alloy Steels.

Modern machine tools and cemented tungsten carbides was to be the topic of a paper by A. A. Merry, and J. M. Highducheck was to speak on grinding.

Special steel for castings will be discussed by R. A. Bull, and E. Touceda will speak on malleable iron as a component part of machines and structures.

Economies and plant management will come in for discussion by a number of speakers.

White Personnel Changes Complete

CLEVELAND, O., Dec. 7—C. H. Wondries, who has been vice president in charge of sales of S.P.A. Truck Corp., will become vice president of the White Co. in charge of the Studebaker division. T. L. Preble, who has been sales manager of the Pierce-Arrow Division of the S.P.A. Truck Corporation becomes manager of the Pierce-Arrow Division of the White Co.

S.P.A. Truck Corp. will pass out of existence but the personnel which has been engaged in the sale of Studebaker truck will become the Studebaker Division of the White Co., effective Jan. 1. Studebaker trucks will continue to be manufactured in South Bend. A new line of Studebaker trucks will soon be offered through White Branches and through the Studebaker dealer organization.

J. M. Cleary, president of the White Co., also announced that the Export Region of the White Co. has been discontinued and the Studebaker Pierce-Arrow Export Corp. is made responsible for the sale of White and Indiana trucks outside of the United States and Canada.

R. L. Boughton, regional vice president, has been transferred from Cleveland to South Bend to continue promotion of export sales of White and Indiana trucks.

G.M. of Canada Adds 1000 Men

OSHAWA, ONT., Dec. 6—Nearly 1000 employees of General Motors of Canada, Ltd., returned to work at the local plant today as production on a larger scale began.

Employees in several departments have been working for some weeks on preparations for new models, but this is by far the largest number to be called back to work since production on 1932 models ceased.

Willys Will Show Cars on January 7

"Lower-Priced Cars Still Too High," Toledo Executive Says in Interview

TOLEDO, Dec. 7—Orders already on hand from dealers will consume Willys-Overland Co.'s entire output for the first six weeks after the plants start production on the company's new line on Dec. 15, John N. Willys, chairman, said.

The new Willys-Overland light car will be exhibited publicly for the first time on January 7 and the price and complete specifications will be revealed at that time.

Mr. Willys said that despite recent price reductions on automobiles, the lower priced cars still are too high and that the company's new line will sell at a price to meet present-day curtailed incomes.

The 1933 line is designed on the principle of complete streamlining, he said. Mr. Willys has just returned from sales meetings on the Pacific Coast.

Purvis With Weaver As Advertising Manager

J. A. (Jud) Purvis, formerly technical editor of AUTOMOBILE TRADE JOURNAL, and more recently managing editor of MOTOR WORLD WHOLESALE, Chilton publications, has been appointed advertising manager of the Weaver Manufacturing Co., Springfield, Ill.

Mr. Purvis will bring to the new Weaver Educational Service and Mechanics' Training School activities the benefit of his thorough technical training and intimate knowledge of the automotive service business.

Eaton Products Gain in Favor

CLEVELAND, Dec. 6—Eaton Mfg. Co. reports that 65 per cent of cars selling for \$2,000 and over are now being equipped with Eaton leaf springs.

Greater care and thought is being given to the design and construction of chassis springs due to the emphasis which is being placed on riding comfort, the company said.

Ninety-four per cent of all U. S. cars are now factory-equipped with one or more Eaton-made products. These include, besides chassis springs, Eaton axles, Eaton bumpers, Rich valves, Wilcox tappets, Wil-Rich piston rings, Easy-on caps, Reliance spring washers and Eaton coil springs.

Mack Trucks, Inc., Pays

NEW YORK, Dec. 8—Mack Trucks, Inc., has declared a quarterly dividend of 25c a share payable Dec. 31.

Firestone Nets \$1.07 On Common for Year

12 Months' Earnings Compare with \$1.26, Before Special Charge in 1931

AKRON, OHIO, Dec. 3—Firestone Tire & Rubber Co. made a net profit of \$5,151,977 on total sales of \$84,337,173 during the fiscal year ending Oct. 31, a report to stockholders by H. S. Firestone, Sr., chairman, shows. This is equivalent, after preferred payments of \$3,024,232, of \$1.07 a share on common.

For the previous year the Firestone earnings were \$6,028,630 on total sales of \$113,797,282.

This 1932 net profit more than covered all dividends on preferred and common stocks for the year. The company paid \$3,024,232 in dividends on the 6 per cent preferred stocks and \$2,041,122 on the common stock which was maintained at the \$1 dividend basis, for a total of \$5,065,355, leaving an undivided surplus of \$86,622, equivalent to about 16 cents a share on common stocks.

The gross profit after all operating expenses were deducted was \$12,482,342 for the fiscal year, the report showed. Deductions totaling \$7,330,364 included \$5,211,893 for depreciations; \$1,200,190 in interest; \$180,272 spent on Liberian plantation developments; \$165,240 in foreign exchange adjustments, and \$572,768 in tax and service store adjustments.

The company's general surplus account showed \$31,147,374 at the end of the fiscal year. Current assets were figured at \$53,262,247, and current liabilities at \$3,923,386, a ratio of 14 to 1.

"With expenses curtailed, with more than a year's supply of rubber and cotton at a cost to us less than the cost of production, with \$13,000,000 in cash and with no bank indebtedness we enter the new year with every confidence," Mr. Firestone said.

"With low production we have had a real problem in giving work to our employees," Firestone said. "For the last two years we have used the six-hour day plan and rotated to provide work for as many as possible. We have also provided additional work by improving our plants and equipment and bringing them to highest efficiency.

"Our program, started over three years ago, of establishing Firestone Service stores in the principal buying centers has proved most helpful to our dealers in stabilizing retail prices and it has given us a more intimate knowledge of retail merchandising."

Clement Studebaker, Jr.

Clement Studebaker, Jr., treasurer and second vice-president of the Studebaker Corp. from 1901 to 1914, died at his home in Chicago on Dec. 3.

He was born in South Bend and

was 61 years of age at the time of his death.

Mr. Studebaker resigned from the automobile company in 1914 and became affiliated with various utility concerns.

Ready Market for Lower Priced Car

Willys Urges Greater Leniency in Providing Credit for Automobile Dealers

NEW ORLEANS, LA., Dec. 6—Greater leniency on the part of finance companies toward automobile dealers was urged here today by John N. Willys, chairman of the board of the Willys-Overland Co. in an address at the national convention of the National Association of Finance Companies.

Such leniency, he said, would result in moving a larger number of cars at retail and at the same time increase factory production, employment and enable dealers to obtain a new start.

He gave definite assurance that his company had completed plans for its 1933 product and that it would include a car ultra-modern in design at lowest initial cost, lowest operating and maintenance cost with ample power and speed performance to meet the most exacting demands of modern motoring.

"The American public has undergone a complete reversal of buying habits in the past two years," Mr. Willys said, "with the factor of economy uppermost in their minds.

"Until our economic conditions changed under the stress of the depression, car buyers gave little thought to economy. If a car appealed to him in appearance and he was reasonably assured that its performance was all that could be expected of a car in that price class, he was satisfied.

"It is different today. The buyer demands lower first costs, lower operating and maintenance costs.

Dun Says Trade Outlook Bright

Holiday Retail Buying in Full Swing, Says Trade Review

NEW YORK, Dec. 6—"The final month of the year has opened under circumstances far more auspicious than were discernible at this period in 1931, as the reports which contain no evidences of fresh gains show a maintenance of previous levels or a decrease in the hesitancy which had been handicapping the forward movement," says Dun's Trade Review.

"The holiday buying season now is in full swing, and retail trade continues to improve sharply, with the dollar totals running close to last year's levels.

"Stores specializing in Christmas toys, novelties and other Yuletide merchandise report early buying of gratifying proportions, and the release of the Christmas savings funds this week will liberalize purchasing further, as it is estimated that fully 40% of the money will be poured immediately into retailers' coffers.

"Increases in the week's distributive totals were particularly outstanding in weather-stripping, varnishes, general household hardware, leather goods, traveling accessories, novelty furniture and housefurnishings.

"The margin of consumption over necessities is increasing more steadily each week, and it is this margin which defines most accurately the extent to which consumer buying is broadening."

Auburn Declares Dividend

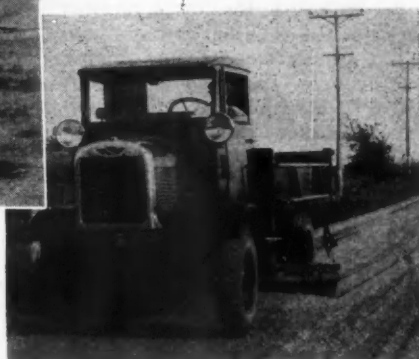
AUBURN, IND., Dec. 6—Auburn Automobile Co. directors declared the regular quarterly dividend of \$1 per share in cash and an additional quarterly dividend of two per cent in stock, payable Jan. 2, to stockholders of record at the close of business Dec. 23.

An old and new method



The old and new, always a dramatic comparison in these days of rapid change, is aptly illustrated by FWD in these pictures.

Left: Road maintenance in Palestine and a new four-wheel-drive truck and scraper.



Chapin Predicts More U. S. Branch Factories Abroad, in Annual Report

Commerce Secretary Points to Imperial Conference Agreements on Preferences Against Imports from American Manufacturers

By L. W. MOFFETT

WASHINGTON, Dec. 6—The possibility of a stronger branch factory movement as the result of the Imperial Conference in Ottawa is predicted by Secretary of Commerce Roy D. Chapin in his annual report.

The Ottawa conference, having set up wider preferences on automotive products in favor of British units as against the United States, Mr. Chapin points to a greater movement toward establishment of branch factories abroad, particularly in England.

"The number of new American branch factories actually established in England within the last year is much smaller than the number established in Canada," says Secretary Chapin, "but the interest aroused among American manufacturers by the changed economic situation in that country would seem to indicate the possibility of a stronger branch factory movement in the future, depending, of course, on the outcome of the Imperial Conference at Ottawa."

The secretary points out that the branch factory movement during the past fiscal year was influenced largely by the same artificial factors as in the preceding year, and the establishment of new branches was largely confined to Canada and, to a smaller extent, to England. In both countries, it is stated, the chief factors have been the tariff, exchange difficulties, and the agitation in favor of domestic products. The Ottawa conference, with its potential influence on the direction of the movement within the British Empire, has naturally received a good deal of attention, Secretary Chapin states.

"In the case of Canada," the report

says, "the number of branches actually established during the year has probably increased in comparison with the preceding year, although the lack of adequate information on the investment involved makes it impossible to determine the real progress of the movement. The discount on Canadian exchange has introduced a new element and has added to the difficulties of marketing American products. On the other hand, the uncertainty to the outcome of the Ottawa conference probably had a retarding effect."

"The radical change in the British tariff policy and the depreciation of sterling have served to attract attention to England as a location for branch factories. It is rather interesting to note that in spite of the great interest aroused among American industrialists, the European manufacturers have shown a much greater readiness to adjust themselves to the new situation by the actual transfer of their industries or the establishment of manufacturing branches. In the case of Germany, the government found it necessary to impose an export duty on second-hand machinery and restrict exchange in an effort to discourage the migration of German plants to England. The reluctance of American manufacturers may be ascribed largely to the fact that a number of the principal producers in the United States have Canadian branches, many of which have been established with a view to supplying the Empire market; those without such branches were inclined to await the results of the Imperial Conference at Ottawa," the report pointed out.

Cadillac Payroll Gains As Car Orders Increase

DETROIT, Dec. 6—An increase in employment, adding 3250 men to the payrolls, bringing the total number employed at the Cadillac and affiliated plants to approximately 3750 during the coming year, Lawrence P. Fisher, president, Cadillac Motor Car Co., said.

"Sufficient orders have been received from the Cadillac distributor organization," Mr. Fisher said, "to maintain our initial production schedule on a basis of five eight-hour working days a week until the end of March."

"Only the regular Cadillac workmen who were on our payrolls prior to the recent shutdown for inventory taking, however, can be employed."

See Four New Lines

DETROIT, Dec. 8—Chrysler Sales Corp. distributors from all parts of the United States and Canada assembled here yesterday and today for a pre-showing of the four new Chrysler lines to be introduced in 1933.

Coolidge Rail Body Hears Auto Chiefs

Industry Executives Present Plans for Transport Coordination Before Rail Committee

NEW YORK, Dec. 8—A committee representing the passenger car and motor truck manufacturers appeared before the National Transportation Committee, of which former President Calvin Coolidge is chairman, yesterday, to present a memorandum on highway transportation and the fundamental principles of the relationship between highway and rail services, it was announced by the National Automobile Chamber of Commerce.

Appearance of the automobile manufacturers before the Coolidge committee followed a meeting of directors of the N. A. C. C. The motor makers' case was presented to Mr. Coolidge and his associates by A. J. Brosseau, vice president of the Chamber, chairman of its truck division, and president of Mack Trucks, Inc.

Mr. Brosseau discussed the actual effect of highway transport on rail operations and suggested how coordination of the various forms of transport can be attained in the best interests of the public and those engaged in supplying these services.

Members of the board of the N. A. C. C. who attended the meeting included:

Mr. Brosseau, Walter P. Chrysler, president, Chrysler Corp.; E. L. Cord, chairman, Auburn Automobile Co.; A. R. Erskine, president, Studebaker Corp.; Byron C. Foy, president, De Soto Motor Corp.; Robert C. Graham, vice-president, Graham-Paige Motors Corp.; Charles D. Hastings, chairman, Hupp Motor Car Corp.; Alvan Macauley, president, N. A. C. C. and president, Packard Motor Car Co.; William E. Metzger, Federal Motor Truck Co.; L. A. Miller, president, Willys-Overland Co.; C. W. Nash, chairman, Nash Motors Co.; Alfred P. Sloan, Jr., president, General Motors Corp.; Alfred H. Swayne, vice-president, General Motors Corp.; and T. R. Dahl, vice-president, White Motor Co.

Permite Holds Sales Meet

CINCINNATI, Dec. 5—The entire sales organization of Aluminum Industries was present at the company's annual sales conference here, Nov. 28 to Dec. 2.

C. W. McDaniel, director of sales, pointed out that 1932 sales of replacement parts were on a par with those of 1931, some districts showing substantial increases.

U. S. Gasoline Consumption, September, 1932

48 States and District of Columbia

	Aug., 1932 Gallons	Sept., 1932 Gallons	Sept., 1931 Gallons	Nine Months Ending With Sept., 1932 Gallons	Sept., 1931 Gallons
Total	1,496,537,000	1,403,808,000	1,511,041,000	11,758,908,000	12,566,336,000
Daily Average	48,275,000	46,794,000	50,368,000	42,916,000	46,031,000
Change from previous year:					
Total decrease ..		107,233,000		807,428,000	
Percentage decrease in					
Daily Average:		-7.10%		-6.77%	

Sir Dugald Clerk, Pioneer Two-Cycle Engine Designer and Scientist, Dies

Sir Dugald Clerk, 78, one of the pioneers of the internal combustion engine and who was responsible for much meritorious development work in connection with such engines during the earlier part of their history, died at his home in Ewhurst, England, on Nov. 12. He was born in Glasgow, Scotland.

Clerk served a four-year apprenticeship with a Glasgow machinery firm and then studied physics and chemistry at Glasgow and Leeds. In 1877 he became connected with the Crown Iron Works of Glasgow, and it was there that he began his experimental work on gas engines.

The Otto four-cycle engine, which proved the forerunner of the really practical internal combustion engine, had been brought out the previous year. In spite of the fact that the general principle of the four-stroke cycle, on which it operated, had been enunciated by Beau de Rochas about 15 years earlier, world-wide patent protection was secured on the Otto engine and in Great Britain the patents were assigned to Crossley Brothers of Manchester.

Others naturally sought to circumvent these patents and to improve upon the Otto engine. One of its shortcomings as compared with the steam engine was that only one stroke out of four was a power stroke, instead of every stroke.

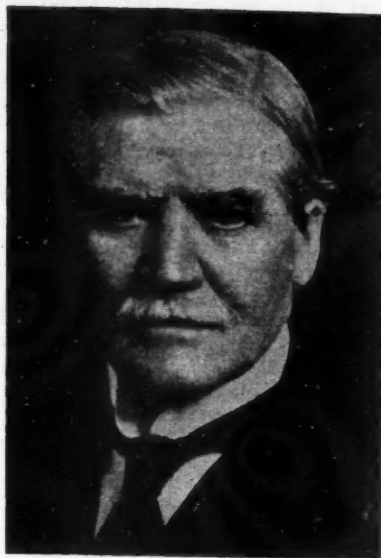
Clerk set himself the task of overcoming this deficiency, at least in part, and he evolved the two-stroke cycle engine, which during its earlier history was frequently referred to as the Clerk engine. In the original Clerk engine the charge was precompressed in an auxiliary cylinder and then forced into the working cylinder toward the end of the power stroke. A certain scavenging action was thus obtained.

For a number of years there was much controversy as to the relative merits of the two-stroke and four-stroke principals, and the argument hinged partly around whether it was preferable to completely scavenge the working cylinder or to retain some of the dead gas in it.

Otto claimed certain advantages for the retention of a portion of the dead gases in the cylinder and "stratification" of the charge.

A good deal of the experimental work conducted by Dugald Clerk was of a broad scientific character. It had been noticed that the temperature of the explosion of a gaseous mixture was much lower than would be expected from the heat content of the charge and the known specific heats of the products of combustion.

He conceived the idea that the specific heats of the gases might not be constant, as had been supposed up to



Sir Dugald Clerk

that time, but increase with an increase in temperature. Experiments carried out by him by exploding gaseous mixtures in closed vessels bore out the supposition. As another factor tending to reduce the temperature of explosion he pointed to afterburning.

Another celebrated series of experiments carried out by Clerk bore on the rate of combustion, and he it was who discovered that this rate could be greatly increased by turbulence of the charge. He developed an apparatus which enabled him to measure the time from the moment of ignition to the moment of maximum pressure in the cylinder.

Dugald Clerk acted as an expert for the complainants in the famous Selden patent case and came to this country to testify.

During the war, Clerk served as Director of Engineering Research for the British Admiralty, as a member of the Advisory Committee for Aeronautics, and as chairman of the Internal Combustion Engine Committee of the Air Ministry.

He took great interest in the development of the motor vehicle, being a member of the Technical Committee of the Royal Automobile Club and serving as judge in many automobile competitions.

Clerk was the author of one of the earliest books on internal combustion engine in the English language, the title of the work being *The Gas, Petrol and Oil Engine*.

He also contributed many papers to scientific and engineering societies, among them a paper on the early history of the internal combustion engine presented to the Society of Automotive Engineers some years ago.

Odds and Ends Bolster Steel Mill Schedules

Youngstown District Finds Support, But Chicago Nears 1932 Low Mark

NEW YORK, Dec. 8—Orders of the odds and ends sort from automotive consumers furnished sufficient support for the unchanged maintenance of operating schedules in Youngstown district rolling mills this week while Chicago district mills were again hovering near the low for the year.

Where dips in activity were recorded, they were accepted as purely seasonal. Little in the way of a decisive upturn is looked for before the turn of the year and quite a few mills may extend holiday shutdowns with a view to permitting the accumulation of small orders, wherever this is possible.

A certain amount of pre-show business, however, is of the kind that calls for the quickest possible shipment and all steel mills are bending every effort not to disappoint their customers, unprofitable as such accommodation is.

Some of these experimental orders for automotive alloy, especially chromium steels, indicate that, regardless of the pressure on prices in the tonnage market, interest in quality steels has by no means abated.

A gratifying development of the week is that both in the ferrous and non-ferrous branches of the metal industry more energetic efforts are being made toward scrapping obsolete equipment and to center production in plants that are thoroughly modern.

The leading steel producer has taken steps to definitely close one of its wire mills that has outlived its usefulness and transfer its activities to one of its more modern mills.

Connecticut Valley brass manufacturers, with the same objective in mind, are carrying on a "rehabilitation" campaign.

Pig Iron—Very quiet and devoid of new features.

Aluminum—Routine conditions prevail.

Copper—The reduction-in-output program which is the main point on the agenda of the world's copper producers conferring in New York this week is meeting with many unforeseen difficulties. Pending the final outcome of these deliberations, the market generally is marking time with electrolytic quoted at 5½ @ 5¼c., delivered Connecticut and Middle West, respectively.

Tin—While the London market showed more activity at the beginning of the week than it has in a long time, demand here is at a standstill with Straits quoted early this week at 22.45c.

Lead—Unchanged.

Zinc—Dormant.

Paris Show Attendance Up

PARIS (Special) — The Paris Automobile Show (Oct. 6-16) showed total paid admissions of 334,500, an increase of 39 per cent over the attendance of last year.

Motor Taxes Now Triple Rail Fees

Sun Oil Executive Hits Fallacy of Excessive Railroad Levies in U. S.

The fallacy of claims that taxes paid by railroads are excessive in comparison with those paid by highway users was exposed by Judson C. Welliver, of the Sun Oil Co., in a recent address before the Pennsylvania Motor Truck Association at Harrisburg.

Mr. Welliver said in part:

"We are constantly belabored with railroad literature telling us that the railroads pay enormous taxes, which help build the highways on which their competitors operate free of cost. Let's see about that.

"For the fiscal year 1930-31, Pennsylvania collected \$31,975,000 in motor vehicle licenses and \$29,304,000 in motor fuel taxes. That makes 44 percent of the state's total tax revenues.

"This does not include property taxes on 2,200,000 motor vehicles, nor on the garages, filling stations, and all the other property incident to maintaining automotive vehicles. There was a total of \$61,279,000 in license and gasoline taxes alone.

"That seems like a tidy bit of money, and, having heard so much about the tremendous railroad taxes, I wrote to the Interstate Commerce Commission for railway taxes in all the state for 1931.

"Imagine my shock to find that the railroads in Pennsylvania paid in 1931 only \$12,000,659 taxes—less than one-fifth of motor license and gasoline taxes and rather less than one-half of the motor licenses and gasoline taxes paid by the trucks of Pennsylvania.

"In 1930, all the Class I railroads in the United States paid \$353,000,000 taxes; in 1931, \$50,000,000 less.

"But gasoline taxes and license fees, paid by the highway users of the nation, went steadily upward. They are now just about three times the total taxation of the railroads."

Soviet-Built Cars Run Successful Test

MOSCOW (Special)—The automobile test run Moscow—Minsk—Moscow was completed Aug. 4. Nine Soviet-built cars participated—three 2½-ton, two 4-ton, one 5-ton and two 8-ton (Yaroslavl) trucks, and one bus. Each machine was loaded to capacity, the bus carrying 15 passengers and their baggage.

The run took 11 days, the cars covering a distance of 1800 kilometers (1125 miles), a third of the total being on poor roads.

The participants had to repair many bridges en route and even build a new

structure, all without any outside aid.

Despite the many difficulties the run was completed without any mishap or breakage aside from a few punctures. The success with which all the cars stood the test is considered proof of the excellence of the output of the young Soviet automobile industry.

A test run of several models of American cars was organized in August in order to determine the feasibility of the various models under Soviet conditions.

The run, which was held under the auspices of Avtodor, the Society for Automobiles and Good Roads, was from Moscow to the Crimea and back, a distance of about 2000 miles.

The American cars participating in the test run were Ford V-18, B and A models, the Plymouth, and the Lincoln 8-cylinder. A truck manufactured at the Nizhni Novgorod plant also took part.

Average Airline Ride Is Becoming Longer

Department of Commerce Shows Passenger Now Flies 275 Mi., Previous Average Was 227 Mi.

WASHINGTON, Dec. 7—The average length of the trips made by passengers on the air lines in continental United States during July, August and September was 275 miles, it was announced by Colonel Clarence M. Young, assistant secretary of commerce for aeronautics.

The average for the preceding three years was 227 miles, and for the six months' period, July-December, 1929, it was 199.

Passengers carried, passenger miles flown and average length of passenger trips since July, 1929, are shown in the following:

Average Length of Passenger Trips in Six-Month Periods from July, 1929, Through June, 1932

Period	Passengers Carried	Passenger Miles Flown	Average Length of Passenger Trips (Miles)
July-Dec., '29	101,566	20,298,527	200
Jan.-June, '30	185,956	40,319,602	217
July-Dec., '30	188,979	43,040,103	228
Jan.-June, '31	169,816	40,855,654	241
July-Dec., '31	300,165	65,586,721	219
Jan.-June, '32	217,588	54,534,746	251
Totals	1,164,070	264,635,353	227

Average Length of Passenger Trips for July, August and September, 1932

Period	Passengers Carried	Passenger Miles Flown	Average Length of Passenger Trips (Miles)
July, '32	53,759	14,774,709	275
Aug., '32	57,995	15,936,363	275
Sept., '32	52,829	14,585,965	276
Totals	164,583	45,297,037	275

Rail Express - Air Freight Speeds Delivery of Trucks

Air-cleaners for 800 Dodge Trucks Shipped in Haste

CLAREMONT, CAL., Dec. 6—High-speed air-express transit over 2,000 miles of air-routes and immediate delivery at Detroit, enabled the Dodge Motor Corp. to fill an export order for 800 trucks without delay for the Bolivian government. An order for 800 air-cleaners was received by the Vortox Co. here by long distance telephone at 4.30 p. m. from Detroit.

All available units were put aboard an electric car of the Pacific Electric Railway for Los Angeles, leaving two hours later. The 300 lb. shipment reached the Los Angeles field and was transferred to the night plane for the East by the Railway Express Agency, while the Claremont factory, working overtime, turned out the remainder of the order, which was dispatched by the same route.

Perfect Circle Votes Regular Dividend

HAGERSTOWN, IND., Dec. 5—The regular quarterly cash dividend on 162,500 shares of common stock outstanding was recently declared by the board of the Perfect Circle Co. The dividend, amounting to 50c a share, is payable Jan. 1, to stockholders as of record on Dec. 17.

Oldfield and Arnold Join Plymouth Forces

Appointment of Barney Oldfield, most famous of all racing drivers, as Highway Safety Adviser for Plymouth Motor Corp. and the affiliation of Billy Arnold as his assistant, is announced today by H. G. Moock, general sales manager.

Moto-Meter Busy

TOLEDO, Dec. 6—Moto-Meter Gauge & Equipment Co. has more than doubled its payroll in the last few months and now has 700 workers busy making new products in a diversification program it has launched in adding to its automotive equipment and radio lines.

Foot-Burt Votes Dividend of 25c

CLEVELAND, Dec. 5—Foot-Burt Co., manufacturers of metal working machinery, will make a disbursement of 25 cents a share on its capital stock.

The last previous dividend was paid March 16, 1931, at which time the payment was cut to 32½ cents from 65 cents quarterly.

Inhibitor of Gasoline Gumming Discovered; Used in Manufacture

Extensive Research by Universal Oil Products Chemists Reveals Necessity for Anti-Gumming Chemical to be Applied to Stocks in Storage

NEW YORK, Dec. 5—Gasolines deteriorate rapidly when exposed to the air, becoming dark colored, high in gum content and lower in knock rating, and the problem of preventing losses resulting from necessary storage is one of long standing in the oil industry. Means have now been discovered of preventing these changes, or at least of greatly retarding them, according to an article by Gustav Egloff, J. C. Morell, C. D. Lowry, Jr., and C. G. Dryer of the Universal Oil Products Co., Published in *Industrial & Engineering Chemistry*.

"In commercial practice gasolines must often be kept in refineries or bulk stations for six months or longer. Many motor cars, moreover have long periods of disuse. It is obvious that a tendency to change during such storage is harmful, they point out.

"Loss of antiknock value seriously lowers the market value of gasoline. Gum in gasoline is likely to deposit in the induction system of an engine, interfere with the operation of the carburetor and intake valves, and even prevent car operation.

"The increased demand in recent years for antiknock motor fuel has made the problem of gasoline stability, as to color, gum, and knock rating, of great importance.

"Among the many factors which influence the rate of deterioration of stored gasoline, the most important is oxygen. Gasoline out of contact with air changes but slowly. In commercial gasoline storage, contact with oxygen is guarded against in many cases but air is usually not entirely absent, even when special precautions are taken. However, gasoline can be effectively protected against oxidation by the addition of antioxidants or inhibitors."

Experiments showed that compounds such as alpha naphthol were effective in preventing oxidation and that only small quantities were necessary. The amount needed depends on the type of gasoline to be treated.

"Comparative tests on inhibitors were made in a uniform concentration of one one-hundredth of one per cent in Pennsylvania cracked gasoline treated with fuller's earth.

"When a compound in this concentration produced a slight change, too small for inhibitive action to be assigned to it with certainty, the test was repeated in five one hundredths of one per cent concentration.

"The compounds tested were in most cases of the highest quality, and in a few cases recrystallized or redistilled technical products were used. Generally the substances did not affect the color of the gasoline."

Mercer Tube Formed Taking Over American

YOUNGSTOWN, Dec. 6—The Mercer Tube & Mfg. Co. has been organized to take over the entire plant formerly occupied by the American Steel Foundries Co. at Sharon, and is expected to be in production by March 1, with 120 men employed.

Equipment for making pipe, couplings and other tubular goods has been ordered for early installation.

F. H. McDowell, of McDowell & Co., Pittsburgh, Pa., will be president; B. A. Small, formerly general manager of the Wheatland Tube Co., vice-president, and H. B. Small, also of Wheatland Tube, secretary and assistant manager.

Defiance Establishes Canadian Subsidiary

TOLEDO, Dec. 5—Defiance Spark Plug Co. today announced the formation of a Canadian subsidiary, to op-

erate a plant in Windsor, Ont., to supply the Dominion and British markets.

Burton A. Maddock will be in charge, and Louis de Boudier, export manager, will be in charge of sales for the Defiance Spark Plug Co., Ltd.

Sterling Sends Diesel Trucks on Test Tour

MILWAUKEE, Dec. 5—Sterling Motor Truck Co., which announced some time ago that it would bring out a number of Diesel-engined truck models, has now sent two of these trucks on an expedition to California.

The trucks carry signs setting forth that they are equipped with 125 hp. Diesel engines, that they can cover 7 miles per gallon, and that the cost of the fuel burned is from 3 to 6 cents per gallon.

The trucks equipped with Diesel engines by the Sterling company have load capacities ranging from 4 tons upward.

They are all of the heavy-duty type.

English Car Sales Show Improvement

September Data Indicate Further Uprising Trend With 63% Gain for Month

LONDON (*Special*) — Preliminary automobile registration figures for September show a further substantial increase in sales of passenger cars in Great Britain, the turnover for the month totaling 10,289 units, an increase of 63 per cent. over the corresponding month of last year, according to W. L. Kilcoin, U. S. trade commissioner.

This marked improvement in sales is attributed entirely to the earlier introduction of new models during the current year, and the active efforts made on the part of dealers to clear old stocks before receiving the 1933 models.

The effect of this policy was first noticeable in August, when sales of private vehicles reached the unexpected total of 8,061 units, a gain of 2,508 over August, 1931.

Bus and truck sales, owing to the economy program adopted by the municipalities and other public bodies and the cautious policies now being pursued by private operators, continued to show a downward tendency.

Motorcycle sales, however, displayed some improvement following an upward tendency in August, the registration figures in September amounting to 2,626 machines, as compared with 2,466 a year ago.

A comparatively recent development is the progress which has been made by the 10 hp. units at the expense of the popular "8's" and to some extent the "9's."

The 8 horse-powered jobs, formerly the leaders, declined to second place in July, and in August were exceeded not only by the tens, but were equaled by the nines.

U. S. Factory Payrolls Up

WASHINGTON, Dec. 6—Factory payrolls increased, volume of industrial production held up to the advances made in August and September, and wholesale commodity prices decreased, stated Federal Reserve Board in its monthly summary of business conditions.

In the textile industries, which had shown rapid expansion during August and September, there was a slight decrease in consumption of raw materials while output of finished products increased somewhat.

Employment in most manufacturing industries increased between the middle of September and the middle of October, and the Board's seasonally adjusted index of factory employment showed an advance from 60 per cent of the 1923-25 average to 61 per cent.

British Super-Highway To Cost \$500,000 per mi.

Road Designed for Heavy
Duty Vehicles Between
Manchester and Liverpool

MANCHESTER (Special)—A super-highway for heavy motor traffic known as the Liverpool-East Lancashire Road is under construction between Manchester and Liverpool, England.

The old narrow road has been replaced over a distance of 25 miles by a new wide road destined to receive an enormous amount of traffic of the heavier kind, and it was laid out in accordance with the latest practices.

That the road was intended for heavy traffic is shown by the fact that the minimum radius of curves is 2000 ft., the minimum radius of connections between grades and level sections, 7500 ft., the maximum grade, 3.3 per cent, and the maximum crown, 1/80.

The road has a total width of 120 ft. There is a central roadway 40 ft. wide. On the sides of this path for pedestrians will be built, and additional paved traffic lanes will be built as soon as the need arises. At each of twenty-four important four corners traffic circles of 120 ft. radius were provided which give perfect visibility. There are no level crossings on the road.

The estimated cost of the road is \$12,000,000 or nearly half a million per mile. At this cost, of course, a very excellent road can be built.

On the subsoil, which in many places was quite defective, there was placed a six inch layer of compressed clinkers. On this foundation was placed a pavement of reinforced concrete slabs fifteen inches thick.

The concrete used was a specially rich mixture having a 1:1.5:3 composition, which after a curing period of 28 days has a crushing strength of 3200 lb. p. sq. in.

Double grids of reinforcing bars were placed in the slabs at three in. from the top and bottom respectively. The pavement was laid down in three strips, the two outer strips being laid first, and then, forty-eight days later, the central strip, without leaving joints.

White to Dissolve Finance Unit, Selling to C. I. T.

CLEVELAND, Dec. 8 — A special meeting of stockholders of White Motor Securities Corp. was called today to act upon proposal to sell property and assets of company, exclusive of cash and goodwill, to Commercial Investment Trust, Inc.

The latter company will make cash payment in return for transfer of

notes, instalment contracts, acceptances and other commercial paper of the securities corporation.

It is planned to call outstanding preferred stock at \$105 and to dissolve the corporation.

Australian Automotive Manufacturer Liquidates

SYDNEY, AUSTRALIA (Special)—The Australian Made Cars & Aeroplanes Ltd., organized for manufacturing automobiles and aeroplanes in Australia, has been liquidated.

Plans of this company aroused interest in American automotive circles.

Standard Reports Excellent Year

LONDON (Special)—Standard Motor Co. during the past year increased sales by 80 per cent and profits by 187 per cent.

The 1933 program of the Standard company was completed before the end of June and deliveries of new models were commenced on July 1. Since that date sales of this new type have totaled 6700 units and in September alone 2400 cars were sold—a new high record for the company.

Export trade exceeded the company's expectations during the past fiscal year, increasing more than six-fold, and the company now is selling cars in 33 countries.

Organizes Company to Finance Shop Equipment

Payments Will Be Made
From Savings, Macy Says

NEW YORK, Dec. 7—Improved Industries Corp., organized to finance purchase of new equipment for manufacturers, is announced by R. G. Macy.

The plan permits industrial concerns to repay the costs of the improvements out of savings. "The company's plan of action is based," Mr. Macy explained, "on the belief that new labor-saving devices can be made to cut production costs to such an extent that contracts for repayment of machinery costs out of future savings can be made with perfect safety by those financing the purchases."

"A contract in which the estimated reduction in the unit cost of production is specified is made with the manufacturer. We figure that the savings will amortize the obligation within three years and the majority of contracts are made for that period."

"In special cases five years or more are allowed. Where the savings are so large that the time can be reduced materially, the benefits of the larger savings are divided with the manufacturer."

The new company, Mr. Macy continued, plans to carry on its work in all industrial fields, depending upon reports from engineers retained in various parts of the country for recommendations concerning the acceptability of applications from individual companies.

+ + CALENDAR OF COMING EVENTS + +

FOREIGN SHOWS

Berlin International Feb. 12-22

CONVENTIONS

Natl. Automotive Parts Assoc. Dec. 12-14
Rubber Mfr.'s Assoc., New York
City, Annual Meeting Jan. 9
Annual Society of Automotive
Engineers Dinner—New York Jan. 12
Highway & Building Congress,
Detroit Jan. 16-20
American Road Builders' Annual,
Detroit Jan. 16-20
Steel Founders Soc. of America—
Annual Meeting—Detroit Jan. 16-21
Annual Society of Automotive
Engineers Meeting—Detroit
Jan. 23-26
American Soc. for Testing Ma-
terials (Annual Meeting) June 26-30

SHOWS

National Automobile Show, New
York Jan. 7-14
Pacific Automobile Show, San
Francisco Jan. 7-14
Los Angeles, Calif., Automobile
Show Jan. 7-15
St. Louis, Mo., Automobile Show Jan. 8-14
Buffalo, N. Y., Automobile Show
Jan. 14-21
Cleveland, Ohio, Automobile Show
Jan. 14-21
Milwaukee, Wis., Automobile Show
Jan. 14-21
Newark, N. J., Automobile Show
Jan. 14-21

Cincinnati, Ohio, Automobile
Show Jan. 15-21
Philadelphia, Pa., Automobile
Show Jan. 16-21
Baltimore, Md., Automobile Show
Jan. 21-28
Detroit, Mich., Automobile Show,
Jan. 21-28
Boston, Mass., Automobile Show
Jan. 21-28
Hartford, Conn., Automobile Show
Jan. 21-28
Harrisburg, Penna., Automobile
Show Jan. 25-28
Rochester, N. Y., Automobile
Show Jan. 23-28
Portland, Me., Automobile Show
Jan. 28-Feb. 4
Washington, D. C., Automobile
Show Jan. 28-Feb. 5
National Automobile Show, Chi-
cago Jan. 28-Feb. 4
Springfield, Mass., Automobile
Show Jan. 30-Feb. 4
Indianapolis, Ind., Automobile
Show Feb. 4-11
Denver, Colo., Automobile Show
Feb. 6-11
Springfield, Ill., Automobile Show
Feb. 9-11
Kansas City Automobile Show Feb. 11-18
Rapid City, S. D., Automobile Show
Feb. 14-18
Evansville, Ind., Automobile Show
Feb. 24-26
Des Moines, Iowa, Automobile
Show Feb. 27-Mar. 4
Seattle, Wash., Automobile Show
Feb. 26-Mar. 4

YOU SAVE MONEY

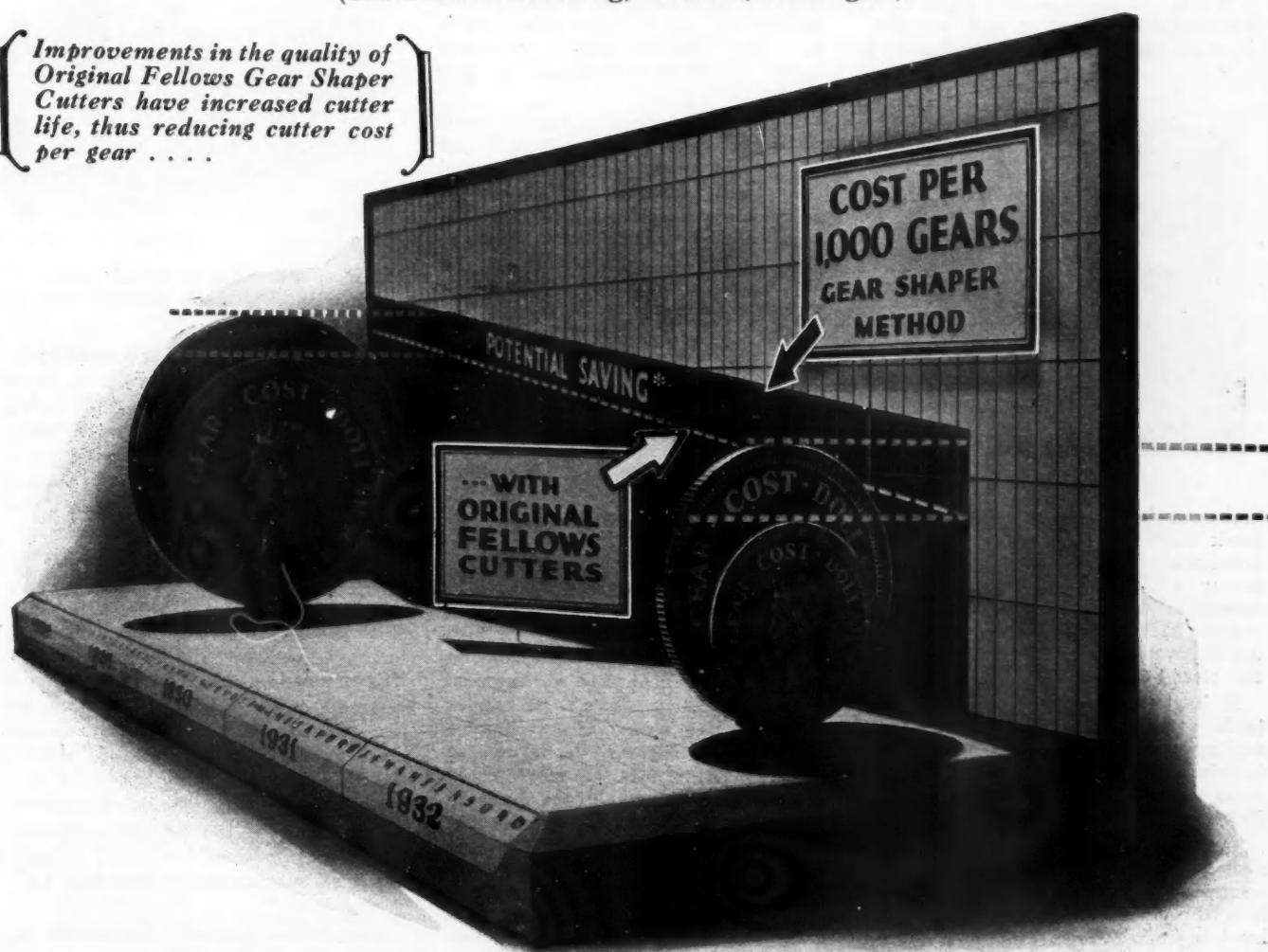
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Cutter costs per gear are now considerably less than three years ago; so that today you get gears of greater accuracy, more quiet in performance, and at much lower cost.

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NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

"Bore-Matic" Precision Finishing Machine

To meet the increasing demand for a simple, faster, single end economical boring machine, The Heald Machine Co., Worcester, Mass., has designed the No. 47 Borematic. Like the No. 46 Borematic, it uses a diamond or tungsten carbide tool for boring and producing holes to a close degree of accuracy and fine finish at a very low cost per piece. It is especially suited for the manufacturer who, while he has work which this machine will handle to excellent advantage, does not require or care to invest in a double end multiple spindle machine, so very desirable for manufacturers having exceptionally large mass production.

While this machine is simple it is automatic in operation and complete in every detail; in fact, it has features



and advantages for many classes of work that no other boring machine possesses. This includes a very fast boring cycle, easily changed boring speeds, exceptional convenience of operation including loading and unloading the work from either the front or end of the machine.

It has a heavy, rugged base and table with ways completely covered and constantly lubricated. The table is driven by a vibrationless hydraulic drive giving any feed from 1 in. to 25 in. a minute.

The same boring heads are furnished that have proved so successful on the Heald No. 46 Borematic. There is a three-position control for these heads: starting and stopping automatically when boring, neutral so they

can be readily turned by hand, and running continuously when so desired. A single 7½ hp. motor drives the entire machine.

Improved Loadmaster Crane Unit Offered With Power Choice

Announcement has just been made that the Loadmaster, manufactured by Bucyrus-Erie Co., South Milwaukee, Wis., will now be available with either Case or McCormick-Deering power, and that the capacity of this crane has been further increased to 4500 lb.

It can be used as a stationary revolving-boom crane, as a crane traveling with its load, or as a tractor. Its mobility, compact design, and special equipment available make it extremely handy for both indoor and outdoor work.

It lifts and swings or carries loads to points where needed. It will load and unload trucks and cars; sort and pile stored material; lift rock, pipe and transformers from and into man-holes and trenches; serve machine tools; assist in overhauling and repair work. It is furnished with either wheel or crawler mounting.

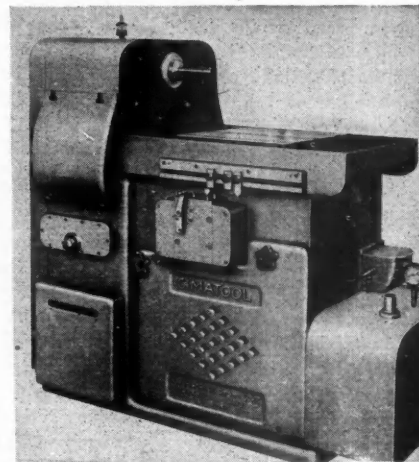
Hose for Pressure- Lubricating

The Armored Tube Co. of Malden, Mass., has developed a new flexible hose which is claimed to possess superior advantages for use in high-pressure lubricating systems. The rubber used for the manufacture of this hose is said to be more resistant to the action of grease than rubbers used for the same purpose heretofore, and since the hose has an internal diameter of ¼ in. there is no danger of it becoming closed by swelling of the rubber. Moreover, the large size of the hole permits of more rapid lubrication. To enable the hose to resist the high pressures used in pressure lubrication, the rubber tubing is wound with several layers of steel wire and cotton. The bursting pressure for this hose is said to be about 12,000 lb. per sq. in. It is further claimed for armored hose that it is

unusually flexible, which is of particular importance in automobile lubrication, where greater flexibility means longer life.

Cimatool Carbide Boring Machine

The Cimatool diamond or carbide boring machine is offered by the City Machine & Tool Works, Dayton, Ohio, for boring holes up to approximately 6 inches in diameter. It is built in both single and double end types and with one or more spindles, according to requirements. Tooling is special to meet requirements of the work. This machine finds application for the boring of the larger sizes of pistons, connecting rods, electric motor



frames, etc. Boring of all kinds of cylindrical valves is another typical job.

In this machine the revolving spindle remains stationary while the work carried on a reciprocating table is fed to the spindle. Operation is semi-automatic in that the operator loads the work-holding fixture and pushes the starting button, after which the cycle is automatic to its completion. Provision is made for quick traverse of the work to the boring tool, and, in the case of interrupted bores, for the quick traversing of the work across such gaps in the bore. After the operation has been completed there is quick return of the work to the starting point. The required sequences of traverse and feed movements are obtained by stops on the table which operate hydraulic valves in sequence for the required forward traverse, forward feed and return traverse movements of the table and work.

The automatic feed mechanism is operated hydraulically.